SEVENTH ANNUAL REPORT

OF

THE DEPARTMENT OF PUBLIC WORKS AND BUILDINGS

Division of Waterways

July 1, 1923

TO

June 30, 1924

C. R. MILLER, Director
WILLIAM L. SACKETT,
Superintendent, Division of Waterways

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ILLINOIS STATE JOURNAL CO.
SPRINGFIELD, ILL.
1925

26416—2M

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NOTE: Owing to conditions beyond control, the publication of this report was delayed. Advantage of this delay has been taken to include in this volume the reports on the Beardstown Flood Protection and the Pecatonica River Flood Protection so that they might be available to the public at the earliest possible date.

LOCKPORT LOCK.
Progress to October 27, 1924.

DIVISION OF WATERWAYS.

WILLIAM L. SACKETT, *Superintendent.*

I have the honor to report the progress of work of the Division of Waterways for the year July 1, 1923 to July 1, 1924.

September 19, 1923 bids were opened for construction at Lockport of the second lock of the five required in the construction of the Illinois Waterway. Green and Sons Company of Chicago were found the lowest bidders. Contract was awarded on October 8, 1923 and work started immediately. This company constructed the Marseilles lock. Being familiar with the work, construction at Lockport has progressed rapidly and favorably. The close of the year finds the contractor nearly ready to start pouring concrete. The work at this point is more difficult than the work at Marseilles and the contractor is confronted by numerous hazards not experienced in the work at Marseilles. Up to this time, however, work has progressed satisfactorily and the experience of the contractors at Marseilles has prevented difficulties that would have resulted in great damage, loss and delay.

Progress in waterway construction has been delayed during the year for several reasons. In March, 1923 Governor Small authorized the Division of Waterways to advertise for and receive bids for the construction of a lock at Starved Rock. Very favorable bids were received but the contract could not be awarded because of litigation in connection with the acquirement of a small tract of land necessary for the location of the lock. This particular litigation could have been avoided by settlement with the owner of the property for the full amount claimed. In an effort to start the contract, Governor Small authorized a settlement of the claim in this particular case. The Attorney General's office, however, when acquainted with this fact, advised the title of this property was such it was necessary there be formal condemnation proceedings to clear up numerous claims against the property to give the State clear title. Proceeding with this case, upon the assumption a satisfactory settlement could be reached, the State was confronted in the county court of LaSalle County with contentions by attorneys for the land owner that raised serious questions both as to the law as well as the plans for the construction of the waterway. The points at issue were fully covered in the Sixth Annual Report of the Division of Waterways. The county court of LaSalle County decided against the State, notwithstanding proof by the State that the party claiming ownership of the land had sold and disposed of it by warranty deed several weeks before the trial of the case. The State appealed from the adverse decision of the county court of LaSalle County to the State Supreme Court. The case was submitted to the latter court by the Attorney General in June, 1923. Up to this time no decision has been rendered by that court. Since it was necessary to have other con-

demnation proceedings in LaSalle County, it was felt no further effort should be made for construction work in LaSalle County on the waterway until a decision in this case had been given by the State Supreme Court disposing of the question raised. If the decision is favorable to the State, there will be little difficulty in making satisfactory adjustments of questions at issue so that the work of construction at Starved Rock may proceed.

OTTAWA AND JOLIET PROBLEMS.

In this connection, unsettled problems at Ottawa were stressed, notwithstanding the fact the city of Ottawa was not a party to the suit. There were two problems requiring adjustment at Ottawa. One was associated with protection to the Ottawa High School. To accomplish this, it was necessary to fill in the grounds approximately four feet, because the normal water level of the river through Ottawa would be raised about seven feet. After investigation and conference between engineers representing the Board of Education and the State, there was reasonable agreement, from the engineering point of view, of the work necessary for the proper protection of the high school building and grounds under the changed conditions.

On March 10, 1924 a conference was held between the members of the Board of Education, the Superintendent of the Division of Waterways and the engineers of the Division, with the result an agreement was reached as to the amount of damages and work necessary to be done. This required an expenditure of $30,800.00, itemized as follows:

Additional borrow area	$ 1,200 00
Sodding of football field	2,200.00
Re-seeding balance of field	350.00
Tiling for drainage of adjacent property, 700 ft. of tile	105.00
Plumbing	5,500.00
Wiring	325.00
Damages to property	5,000.00
Earthwork—fill—estimate 31,000 yds. @ 52c	16,120.00
	$30,800.00

The State reserved the right, however, to ask for bids for changes in plumbing agreed as necessary and for filling the grounds. The State asked for bids on these two items, with the result that a saving of $300.00 was made compared with the estimated cost of the work agreed upon, and contract for filling in and raising of the grounds was made at a saving of $5,270.00. Therefore the net cost to the State of settlement of this situation was $25,230.00.

At the close of the year for which this report is written, the contractors are rapidly proceeding with the changes in the plumbing and in the filling of the grounds, the latter work being done under the direction of J. B. Bassett, Division Engineer at Ottawa.

The settlement of this school situation at Ottawa removed one of the most serious difficulties necessary to adjust before construction work at Starved Rock proceeds. The State still has the proposition of adjusting with the city of Ottawa questions arising with reference to its outlet sewers. Negotiations are pending with reference to this

question and it is believed no serious difficulties will be encountered in reaching final settlement. There are still other questions to be adjusted in LaSalle county, one in connection with county property, but the city of Ottawa has no intesest in these problems and the State anticipates no serious difficulty in reaching a satisfactory adjustment of problems in which the county itself is interested.

Plans were submitted on April 16, 1923 to the city of Joliet in connection with waterway construction there. City officials and engineers had opportunity of checking plans submitted. There were conferences with engineers representing the Division of Waterways. Many of the objections on the part of the city were met and it was anticipated an agreement with the city of Joliet would be reached at an early date. Following the preliminary engineering conferences, however, the city named an advisory board of five engineers residing in the city of Joliet. After consideration of plans submitted by the State these engineers recommended a number of changes which the State felt could not be adopted. The most serious of these was a proposal for what is termed a two level plan of construction through the city of Joliet instead of a one level plan as proposed. There were also objections to designs for bridges necessary in Joliet, the claim being made that the city would be handicapped by grades indicated in the reconstruction plans of bridges. Engineers for the Division of Waterways pointed out that the two level proposal would require an additional expenditure of nearly a million and three-quarters over the proposed one level plan. It would mean an additional lock which would be an obstruction to navigation as proposed and was a deviation in the plans submitted by the State to the Chief Engineers of the Federal Government and upon which the Secretary of War issued the permit required under Federal statute to the State of Illinois to proceed with this work in March, 1920.

The special board of engineers named for the city raised numerous other questions which cannot be accepted by the State. The State concedes that so far as any waterway work in the city of Joliet is concerned the city should be given ample protection to both life and property and that sewerage facilities interfered with must be cared for, but beyond plans guaranteeing protection in these two particulars, no city has a right to determine for the State or the Federal Government what plan of construction shall be followed. At the conclusion of the year the city of Joliet still has the plans and has made no decision thereon, so that waterway work in Joliet which might have been in progress has not started. The Joliet situation is the most difficult one so far as any city on the route is concerned, the work at Joliet requiring an expenditure of several million dollars.

The engineering report for the year follows:

ENGINEERING REPORT UPON THE ILLINOIS WATERWAY.

By M. G. Barnes, *Chief Engineer, Division of Waterways.*

The Illinois Waterway engineering work has been continued during the fiscal year with L. D. Cornish, Assistant Chief Engineer, in charge of all matters not personally taken care of by the Chief Engineer. Walter M.

Smith, Chief Designing Engineer, was in charge of designs, plans and special investigations; Murray Blanchard, Hydraulic Engineer, in charge of hydraulic and special investigations; Sutton Van Pelt, Construction Engineer, on construction and special assignments; J. B. Bassett, Division Engineer, was in charge of the Division office at Ottawa and field operations, assisted by R. S. Heath, Resident Engineer, and A. N. Dunaway, Assistant Engineer.

Sutton Van Pelt, and also F. N. Bradley, Bridge Engineer, resigned during the year to accept more remunerative positions.

SURVEYING AND MAPPING.

The survey party, working under the field direction of T. F. Levan, continued the survey of the lowlands along the Illinois River and tributary creeks to cover such territory that might be affected by a raised water elevation in the Illinois River.

The area covered extended from a point four miles east of Morris, Illinois to the E. J. & E. railroad bridge, near the site of the proposed Dresden Island lock and dam. The work was completed in October and the party was disbanded.

The nature of the survey was the same as described in previous annual reports and is intended to furnish data to be used in determining the extent and location of all land to be appropriated for overflow purposes.

It was found that land subject to possible overflow was confined entirely to stream banks and sloughs where the vegetation was very dense. This condition required a continual cutting of brush and weeds and made the progress of the party very slow.

Following the completion of the field surveys, the work of assembling data secured in the field was begun by the office force. The field notes were reduced, base and section line points were checked and traverses adjusted, co-ordinates for control points were computed and maps of surveys in units of land sections were platted. Limits of private ownerships of land were located by reference to deed records in the County Recorder's office and such limits shown on the maps.

The outlines of the land subject to future overflow were located on the maps and descriptions of traverses by metes and bounds for such outlines were computed from the maps. Plats of individual ownerships were made and legal descriptions of the portions of land to be taken were written.

At the close of the year 65 plats and descriptions had been prepared. This completed the plats from Starved Rock up river, to vicinity of Morris, Illinois, except those lying within the city limits of Ottawa and Marseilles.

CONTRACT WORK.

Contract No. 1 with the Green & Sons Company for the construction of the Marseilles Lock was practically completed during the previous year. Small amounts of excavation in the east approach, backfilling, soiling and slope paving were completed in July and the plant was removed to the contractors' yard on the north bank of the river, except the cableway over the river, which is still in place. The completed lock was accepted by the State August 31, 1923.

The total amount of work done on this contract was as follows:

Item.	Character of Work.	Quantity.	Amount paid.
A	Clearing	Lump Sum	$ 10,000 00
B	Cofferdam	Lump Sum	50,000 00
C	Excavation	225,854.18 cu. yds.	451,708 36
E	Embankment	2,880.72 cu. yds.	10,082 52
F	Stone paving	1,535.23 cu. yds.	5,373 31
G	Pine and fir timber	2.0 M.B.M.	200 00
H	White oak timber	2.0 M.B.M.	500 00
I	Structural steel	127,416.8 lbs.	25,483 36
J	Steel castings	54,780 lbs.	21.912 00
K	Gray iron castings	15,818 lbs.	4,745 40
L	No. 1 concrete	146.39 cu. yds.	1,829 88
M	No. 2 concrete	55,921.34 cu. yds.	603,950 47
N	No. 3 concrete	4,230.16 cu. yds.	43,570 65
O	Metal reinforcement	75,147.9 lbs.	9,017 75
R	Wire fence	2,502.6 lin. ft.	2,502 60
S	Vitrified pipe, 6-in. diam	1,634 lin. ft.	1,634 00
T	Pipe railing	986.5 lin. ft.	493 25
U	Fibre conduit, 3-in. diam	2,306.8 lin. ft.	2,306 80
W	Seeding	2.3 acres.	575.00
Ex. 1	Mach. hollow quoins	Lump Sum	350 00
Ex. 2	Office and quarters building, bath and washroom and fittings	Lump Sum	500 00
Ex. 3	Gasoline pump and pipe line	Lump Sum	150 00
			$1,246,885 35
	Extra cost of labor and materials guaranteed by State		22,398 63
	Total cost to State		$1,269,283 98
	Contractors' bid price		1,375,115 00
	Saving on expected cost		$105,831 02

LOCKPORT LOCK CONTRACT NO. 4.

Drawings were completed for this contract and bids were called for and opened on September 19, 1923. Included in the bids were the miter lock gates and culvert valves for both Lockport and Marseilles locks. Bids were asked at the same time on three separate contracts as follows: No. 4a, Lockport Lock as originally planned; No. 4b, containing the miter gates and culverts at Lockport Lock; and No. 4c containing the miter gates and culvert valves at Marseilles Lock.

A copy of the bids is appended.

In the bids received it was thought that the prices for steel work for the miter gates were too high therefore bids on Contracts Nos. 4, 4b and 4c were rejected and the bid of Green & Sons Company, No. 705 Tower Building, Chicago, for Contract No. 4a was accepted. The contract was awarded to them on October 8, 1923, and work started immediately with the same organization that built Marseilles Lock.

An engineering force in charge of R. S. Heath began the work of locating lines and control points on the 11th. Since that date, the construction work has been continuous although slow progress has been made due to unfavorable weather during the winter and spring of 1924.

The progress up to the end of the year is shown as follows:

Camp Buildings.

A camp for the working forces was constructed on leased land near the site, consisting of bunk and mess houses and engineers' quarters, all of which was lighted and heated, and provided with all necessary conveniences.

Plant.

The assembling of plant and its erection was started immediately after the signing of the contract. At the end of the fiscal year the net result was about as follows:

A new drilling outfit was installed, including special machinery in the blacksmith shop for sharpening drill bits. Two steam shovels and a large amount of track material had been transferred to the work from the Marseilles yard of the contractor. Material for a new high powered cable-

way, capable of handling about seven cubic yards of concrete or waste rock, was received and towers framed and erected ready for the installation of handling machinery and cables. Runways and embankments for the cableway were constructed. Yard tracks, including a bridge across Deep Run Creek, were laid for the disposal of waste excavation. Pumps were installed for unwatering the lock pit and a water supply line and pressure tanks were installed for concrete purposes.

Excavation.

Actual construction operations started by way of stripping top soil from rock surface on Monday, October 22, by the small steam shovel No. 18. The waste was handled by motor dump trucks and was deposited along the east side of the lock pit and in embankments for future use as a cableway track. Excavation with this shovel was continued intermittently during the balance of the year.

Excavation of blasted rock by shovel No. 70 was carried on for a few days only in February. On March 19 this shovel again stated work and operated continuously until the close of the year, except for considerable interference by bad weather and water in the pit due to excessive rains. Practically all of the waste rock was hauled from the pit by dump trains and was deposited in a waste area south of the lock designated as "Area C."

About 44,714 cubic yards of excavation were executed.

Channeling.

Channeling of rock face at the sides of the lock pit was carried on in connection with the drilling for blasting whenever necessary. In some cases clay pockets in the rock prevented this work.

About 10,312 square feet of face were channeled during the year.

Cofferdam, Pumping, Etc.

The work under this item was confined entirely to the construction of sumps and drain ditches in the lock pit and the operation of pumps. No cofferdam was constructed.

In General.

Weather conditions, except for the first two months of the period, have been unfavorable for contract work. The extreme cold weather during the winter followed by continuous rains in the spring and early summer necessitated frequent stopping of operations.

The amount earned upon this contract during the fiscal year was $118,834.00, which is 8% of the total contract price.

WATERWAY EXHIBITS.

Four working models of a lock showing the method of operation, together with four sets of pictures and maps, were exhibited at various fairs throughout the State during August and September.

These exhibits were in charge of engineering personnel of the Division of Waterways, who showed and explained the operation of a lock, and by short talks and folders furnished the audiences with facts and commercial statistics relative to the advantages of waterways in providing the cheapest possible method of freight transportation.

PLANS.

Nearly all of the plans and specifications for the masonry of the lock and dam structures other than the Marseilles Dam have been completed.

The work from the Brandon Road Bridge to and through the City of Joliet, previously contemplated to be done under one contract, has been subdivided and special plans prepared for all work through the City of Joliet. These plans were submitted to the city officials of Joliet for their approval. Several conferences were held with Joliet officials, and it is

CONTRACT No. 4, 4A, 4B AND 4C.

CONTRACT NO. 4—CANVASS OF BIDS RECEIVED SEPTEMBER 19, 1923—CONTRACT NO. 4A.

Item No.	Item.	Unit.	Quantities.	M. E. White Co. 130 N. Wells St. Chicago.		Greene & Sons Co. 705 Tower Bldg., Chicago.		Quantities.	Great Lakes Dredge & Dock Co. 104 S. Michigan Ave., Chicago.		M. E. White Co. 130 N. Wells St., Chicago.		Byrne Bros. Construction Co. 358 E. 115th St., Chicago.		Greene& Sons Co. 705 Tower Bldg., Chicago.	
				Price.	Amount.	Price.	Amount.		Price.	Amount.	Price.	Amount.	Price.	Amount.	Price.	Amount.
A	Clearing	Lump sum	1		$ 3,000 00		$ 8,750 00	1		$ 10,000 00		$ 3,300 00		$ 3,200 00		$ 8,750 00
B	Cofferdams, pumping, etc	Lump sum	1		73,000 00		190,000 00	1		320,000 00		73,000 00		166,000 00		190,000 00
C	Excavation	Cu. yd	171,000	$ 3 50	598,500 00	$ 2 00	342,000 00	171,000	$ 2 72	465,120 00	$ 3 50	598,500 00		473,000 00	$ 2 00	342,000 00
D	Channeling	Sq. ft	39,000	1 00	39,000 00	50	19,500 00	39,000	1 25	48,750 00	1 00	39,000 00	$ 1 27	49,530 00	50	19,500 00
E	Pine and fir timber	M. ft. B.M	21	100 00	2,100 00	100 00	2,100 00	12.3	170 00	2,091 00	100 00	1,230 00	100 00	1,230 00	100 00	1,230 00
F	White oak timber	M. ft. B.M	18	200 00	3,600 00	200 00	3,600 00	4.4	200 00	880 00	200 00	880 00	200 00	880 00	200 00	880 00
G	Structural steel	Pound	1,564,000	10½	164,220 00	10	156,400 00	1,504,000	13	203,320 00	10½	164,220 00	15	234,600 00	10	156,400 00
H	Steel Castings	Pound	167,000	24	40,080 00	17	28,390 00	167,000	25	41,750 00	24	40,080 00	30	50,100 00	17	28,390 00
I	Gray iron castings	Pound	22,000	18	3,960 00	12	2,640 00	22,000	18	3,960 00	18	3,960 00	25	5,500 00	12	2,640 00
J	Steel forgings	Pound	36,000	18	6,480 00	24	8,640 00	36,000	35	12,600 00	18	6,480 00	25	9,000 00	24	8,640 00
K	Concrete	Cu. yd	96,600	6 50	627,900 00	6 60	637,560 00	96,600	8 86	855,876 00	6 50	627,900 00	9 50	917,700 00	6 60	637,560 00
L	Metal reinforcement	Pound	30,500	55	1,677 50	5	1,525 00	30,500	8	2,440 00	55	1,677 50	10	3,050 00	5	1,525 00
M	30″ vitrified pipe	Lin. ft	18	7 00	126 00	5 00	90 00	18	6 45	116 10	7 00	126 00	5 00	90 00	5 00	90 00
N	30″ vitrified pipe specials	Each	48	25 00	1,200 00	16 00	768 00	48	35 50	1,704 00	25 00	1,200 00	20 00	960 00	16 00	768 00
O	24″ vitrified pipe	Lin. ft	58	5 00	290 00	3 00	174 00	58	3 00	174 00	5 00	290 00	3 00	174 00	3 00	174 00
P	24″ vitrified pipe specials	Each	4	15 00	60 00	12 00	48 00	4	10 75	43 00	15 00	60 00	15 00	60 00	12 00	48 00
Q	18″ vitrified pipe	Lin. ft	600	2 50	1,500 00	2 70	1,620 00	600	1 90	1,140 00	2 50	1,500 00	1 60	960 00	2 70	1,620 00
R	18″ vitrified pipe specials	Each	29	8 00	232 00	8 00	232 00	29	6 35	184 15	8 00	232 00	10 00	290 00	8 00	232 00
S	8″ vitrified pipe and specials	Lin. ft	170	1 00	170 00	1 00	170 00	170	66	112 20	1 00	170 00	2 00	340 00	1 00	170 00
T	6″ vitrified pipe and specials	Lin. ft	1,770	75	1,327 50	15	265 50	1,770	51	955 80	75	1,327 50	1 20	2,124 00	15	265 50
U	4″ vitrified pipe and specials	Lin. ft	120	50	60 00	40	48 00	120	45	54 00	50	60 00	75	90 00	40	48 00
V	1, 2, 4½ and 6″ W. S. pipe and railings	Pound	21,000	27	5,670 00	15	3,150 00	15,000	40	6,000 00	27	4,050 00	50	7,500 00	15	2,250 00
W	6 and 8″ C. I. pipe and specials	Pound	12,800	12	1,536 00	7	896 00	12,800	25	3,200 00	12	1,536 00	10	1,280 00	7	896 00
X	Valve sets for shutt. gate	Each	6	825 00	4,950 00	390 00	2,340 00	6	257 00	1,542 00	825 00	4,950 00	800 00	4,800 00	390 00	2,340 00
Y	6″ quick opper. gate valves	Each	3	55 00	165 00	40 00	120 00	3	60 00	180 00	55 00	165 00	60 00	180 00	40 00	120 00
Z	3″ fiber conduit	Lin. ft	3,850	30	1,155 00	40	1,540 00	3,850	45	1,732 50	30	1,155 00	50	1,925 00	40	1,540 00
AA	Lift gate machinery	Each	2	26,500 00	53,000 00	20,000 00	40,000 00	2	27,600 00	55,200 00	26,500 00	53,000 00	24,750 00	49,500 00	20,000 00	40,000 00
BB	50 H. P. electric motors	Each	2	2,000 00	4,000 00	2,000 00	4,000 00	2	3,530 00	7,060 00	2,000 00	4,000 00	2,000 00	4,000 00	2,000 00	4,000 00
CC	Gates for culvert valves	Each	8	2,300 00	18,400 00	2,000 00	16,000 00	4	2,100 00	8,400 00	2,300 00	9,200 00	3,500 00	14,000 00	2,000 00	8,000 00
	Total				$1,657,359 00		$1,472,566 50			$2,054,534 75		$1,643,249 00		$2,007,053 00		$1,460,076 50
	Miter gates, etc.—															
DD	Structural steel	Pound	2,560,000	12	$307,200 00	13	$332,800 00									
EE	Steel castings	Pound	126,000	22	27,720 00	22	27,720 00									
FF	Steel forgings	Pound	42,000	24	10,080 00	24	10,080 00									
GG	Special steel forgings	Pound	10,200	75	7,650 00	76	7,752 00									
HH	Forged monel metal	Pound	7,750	90	6,975 00	88	6,820 00									
II	Spring steel	Pound	3,000	24	720 00	24	720 00									
JJ	Lead alloy	Pound	13,600	50	6,800 00	82	11,152 00									
KK	Bronze	Pound	1,850	62	1,147 00	62	1,147 00									
	Total				$368,292 00		$398,191 00									
	Grand total				$2,025,651 00		$1,870,757 50									

CONTRACT NO. 4B—PENN BRIDGE CO., BEAVER FALLS, PA.—CONTRACT NO. 4C.

B	Cofferdams, pumping, etc	Lump sum	1		$ 7,000 00			1		$ 7,000 00						
E	Pine and fir timber	M. ft. B.M	2.2	$110 00	242 00			6.5	$ 110 00	715 00						
F	White oak timber	M. ft. B.M	3.4	155 00	527 00			10.2	155 00	1,581 00						
V	Pipe railings and fittings	Pound	1,500	23	345 00			4,500	23	1,035 00						
DD	Structural steel	Pound	1,225,000	11¼	142,100 00			1,335,000	11¼	154,860 00						
EE	Steel castings	Pound	42,000	20½	8,526 00			84,000	20½	17,052 00						
FF	Steel forgings	Pound	10,500	22	2,310 00			31,500	22	6,930 00						
GG	Special steel forgings	Pound	3,700	69	2,553 00			6,500	69	4,485 00						
HH	Forged monel metal	Pound	1,940	80	1,552 00			5,810	80	4,648 00						
II	Spring steel	Pound	750	22	165 00			2,250	22	495 00						
JJ	Lead alloy	Pound	6,100	74	4,514 00			7,500	74	5,550 00						
KK	Bronze	Pound	450	56	252 00			1,400	56	784 00						
CC	Gates for culvert valves	Each						4	1,910 00	7,640 00						
	Total				$170,086 00					$212,775 00						

hoped that their approval will be obtained early in the next fiscal year as there are no other pending difficulties to prevent the immediate construction of the work through Joliet.

Plans were prepared for several bridges over the Illinois and Michigan Canal, contracts were let and construction work was supervised by engineers from this office. For further information relative to these bridges reference should be made to the report on the Illinois and Michigan Canal elsewhere in this volume.

A field party in charge of Murray Blanchard, Hydraulic Engineer, assisted by W. G. Potter, Drainage Engineer, made the survey and maps necessary for the preparation of plans for flood protection of the City of Beardstown. The report on this subject follows:

POWER DEVELOPMENT AT DAYTON.

On the 24th day of May, 1923 the State, under authority of the power vested in the Commissioners of the Illinois and Michigan Canal, leased certain State rights and property at Dayton in LaSalle County to Fred D. Breit. In earlier days the Illinois and Michigan Canal was supplied with water at Ottawa by what was known as the Fox River feeder. To maintain this feeder a dam was constructed in the Fox River at Dayton. As a result of this construction some power was developed, the owners of the land receiving most of the benefits therefrom, the State having the water supply for purposes of navigation thus provided. In about the year 1912 floods carried out this dam. The Canal Commissioners had no funds with which to restore it. In consequence various persons sought to acquire property rights of the State, claiming the State only had an easement which it lost when it no longer maintained the dam and used the right of way of the feeder for carrying water to supply the Illinois and Michigan Canal. Fred D. Breit and others interested in this situation sought to obtain the property and ignore the rights of the State. The Superintendent of the Division of Waterways however, did not concur in the views advanced but insisted the State had rights in this situation it could not be deprived of. As a result of investigation covering a period of more than a year the Attorney General confirmed the position of the Superintendent of the Division of Waterways as to State ownership of certain tracts of land essential to the development of water power at this point. The rights of the State are thus conserved in perpetuity as a result of lease entered into with Breit, and as a result thereof and of the development of water power at this point the State is to receive an initial revenue of $1,500.00 a year. Its lease with Breit provides a certain percentage revenue of the amount of power developed, and the lease affords complete protection to the State as to future operation. In addition, the State also provides that the dam cannot be removed without its consent and the same terms and provisions applied to the situation as are provided in the Federal Power Commission Act, so that after a term of years if the State of Illinois desires to acquire this water power development it can do so upon the payment of the amount actually invested in its development. The State therefore protected all rights which it had and also has protected the public to the extent of acquiring this development if at any time in the future it becomes of sufficient value to induce such action.

CHESTER PENITENTIARY WATER SUPPLY.

For several years the Southern Illinois Penitentiary at Menard has depended upon a small spring in nearby hills for its drinking and culinary water supply. It is very limited and may fail at any time. An objectionable feature in connection with this limited water supply is found in the fact water is handled in buckets by prisoners and is thus subject to possible contamination. Water for sanitary purposes is obtained from the Mississippi River. The river water, however, contains a large percentage of sand and mud which makes it at times practically useless for bathing and other purposes. Furthermore, the grit in the water cuts away valves at a rapid rate which results in plumbing being in bad order a large portion

of the time and a considerable expense for maintenance and repairs. For many years trouble has been encountered in maintaining the necessary intake. As at present located it is out from the pumping station and located in a portion of the river where sand bars form and shift continually. Thousands of dollars have heretofore been spent for intake pipes only to have them covered up or washed away.

In view of the unsatisfactory water supply and the large cost of replacing and repairing in this and plumbing fixtures, the General Assembly in 1921 made an appropriation for improving the water supply and for making changes in the present sewerage system. However, the work had not been accomplished when the 53rd General Assembly convened in 1923, and the amount for the work therefore re-appropriated. The Department of Welfare requested the Department of Public Works and Buildings to take charge of this work. It was turned over to the Division of Waterways. Mr. M. C. Sjoblom, Sanitary Engineer of the Division, was placed in charge of the work. Plans were devised for a modern filter plant, Mississippi River water being used for the supply. The work includes the construction of a large clear well, a filter building and sedimentation basin, a low lift pumping station and an intake well. The intake and low lift pumping station will be located about a mile below the present pumping station adjoining the Chester intake. Here the current of the Mississippi River maintains a clear channel and no intake troubles have been experienced in the years the Chester plant has been in operation. The water works system also requires the laying of considerable pipe. In addition to the construction of the water works the Division of Waterways is building a sewer to carry the prison sewage to a point immediately below the Chester intake and below the new prison intake for water supply. The construction of this sewer was deemed necessary because of the continual complaint of the people of the city of Chester of the discharge of raw prison sewage into the mississippi River at a point a mile upstream from the location of the intake for the water supply of that city.

This work has been in progress since January, 1924. It is hoped the work will be completed prior to the first day of December of this year. Most of the labor is being performed by prisoners, however, and the progress of the work is not so rapid as would be the case if it could have been done by contract. The cost, however, will be within the appropriation if the work is done by prisoners. If done by contract it would be much in excess of the amount of the appropriation.

The Division of Waterways furnishing engineering service and supervision of this work is indicative of the benefits of the present code system of government. As a result the Department of Public Welfare has had all of the benefits of the corps of engineers maintained by the Division of Waterways in connection with other work and no additional cost of administration has been necessary to undertake this work at the Chester Penitentiary in addition to the regular work of the Division of Waterways.

STREAM POLLUTION.

One of the greatest evils of the present time is the pollution of lakes and streams of the State. This practice is not followed in Illinois alone but is nation-wide. With the increase of population many of the streams and lakes are being destroyed, so far as fish propagation is concerned and lakes are rendered unfit for public use, for water supply or bathing. The Illinois River, which was once one of the most productive sources of fish propagation, from which millions of pounds annually were taken and sold in eastern markets, has had all its fish killed as far south as Peoria Lake because of the excess amount of raw and untreated sewage disposed of by the city of Chicago which goes through this river. The present laws of the State give to the Division of Waterways supervision of the streams and the lakes of the State and the practice is now followed of prohibiting sewer connections with any of the streams or lakes of the State unless means for treatment of raw sewage is provided in connection therewith so that the effluent discharges into the lake or stream will be innocuous. The

State supervises work of this character through its Division of Waterways and through the Sanitary Division of the Department of Health. These two Divisions co-operate and pass upon the proposed plans in each and every case. The Division of Waterways has some advantages over the Department of Health so that in most cases where sewers are connected to discharge into streams or lakes, contracts can be exacted for control of the situation in future years. The Division of Waterways maintains no laboratories for analysis but under the civil code administrative law it has the co-operation of the State Water Survey Division and these three divisions are enabled to co-operate in the solution of these various problems without any overlapping, in either service or expenditure. While it has not been possible to compel the removal of sewer outlets connected with rivers and lakes during the last fifty years, it has been possible, under the present laws of the State, where the growth of communities has been such as to grossly pollute the rivers and lakes, to compel the installation of suitable plants for the treatment of sewage and thus conditions have been improved. Financial ability of communities must be considered in connection with work of this character. This Division has insisted upon changes as rapidly as municipalities were able to finance the work.

Some communities have availed of the law which permits organization of sanitary districts. As a result two or three extremely bad situations have been cleared up in the last year or work started for this purpose which will improve conditions upon completion with the next year or two. So far as possible no new sewer outlets are permitted with streams or lakes where treatment is not first provided for or if permitted under contract requiring treatment shall be provided for within a limited period of time. Much difficulty is experienced, however, in this work along the Illinois River and some of its tributary streams because of the excess pollution resulting from the discharge of untreated sewage by the Sanitary District of Chicago into the DesPlaines and Illinois rivers. Under laws recently enacted by the General Assembly, which have extended the territorial limits of the Sanitary District of Chicago to include a number of municipalities along the DesPlaines River, much difficulty is experienced in preventing the undue pollution of the DesPlaines River by the discharge of sewage from these municipalities therein. Being now included within the limits of the Sanitary District of Chicago, the municipalities are unwilling to meet the expense for the installation of treatment plants, insisting this is the duty of the Sanitary District of Chicago. The Sanitary District is not making the progress in installation of treatment plants that it should within the original limits of the District, which originally did not extend beyond the limits of the city of Chicago. This work by the Sanitary District of Chicago is referred to in more detail elsewhere in this report, with certain suggested recommendations of limited State authority in connection with the administration of this District if the Chicago sewage problem is to be solved within a reasonable span of time and the people of the Illinois Valley and other parts of the State relieved of the nuisance now resulting from present practices.

The authority given the Division of Waterways and the Department of Health to supervise methods of sewage disposal throughout the State is a material aid in preventing abuses that have grown up in the past prior to State supervision, the State requiring now the installation of properly designed disposal plants of a capacity to scientifically treat raw sewage so that the effluent will not pollute any stream or lake into which it is discharged to an extent as to deprive the public of its rights and benefits therein.

Sanitary districts may be organized giving towns and cities necessary authority and means to finance work of this character and to protect natural water supplies. The practice of sewage disposal into streams and lakes has continued from the time when communities were small and the amount of foreign matter was small in proportion to the dilution that could be obtained. As the population grew in volume the sewage increased until at the present time practically all the public waters in the State are

polluted to greater or less degree, and resulted in conditions that are a menace to the health of everyone not especially protected by sewage disposal plants and purification of the domestic water supply.

It is not unlikely public opinion will be aroused to a point where every locality will be under investigation by its own citizens by reason of desire of so many to enjoy boating, bathing and not least in point of importance, that of fishing in clean, unpolluted water.

Acid wastes from farm dairies and machine shops are less noticeable than some other forms of pollution, yet they are more deadly to fish life and more difficult to control. The same may be said of gas house wastes and the washings from garages and all three of this group are very objectionable.

The Isaac Walton League has taken an interest in all forms of pollution in public waters and can, if so disposed, be of much assistance to the Division of Waterways by giving information as to violations of law coming to attention.

PERMITS.

Permits issued July 1, 1923 to June 30, 1924.

During the year 183 permits have been issued by the Division of Waterways as follows:

Repair docks	42
Sewerage systems	20
Bridges	29
Dams	7
Bulkheads	4
Jetties or piers	8
Shore walls	20
Dredging	18
Temporary piers	7
Drainage districts	2
Intakes	6
Overhead electric transmission cables	4
Submerged cables	2
Miscellaneous	14
	183

Supervision of the streams was found necessary in the public interest to prevent unlawful encroachment, obstructions that would result in avoidable floods and in preventing other abuses. No charge is made for these permits but engineering investigation is necessary in nearly every instance. Under the requirements of the present laws of the State, the Division of Waterways has been able in the protection of public interest to point out deficiencies in plans submitted and to assist those interested in the development of the water resources of the State. There have been instances of violations of law but in most cases these have been adjusted satisfactorily without litigation or hearings.

BRIDGES.

Approval by the Department of plans of all bridges must be secured before the construction may now be legally undertaken. This is a safety measure, as the Department must be reasonably sure that the flood plane has not been restricted to a point that would endanger the lives or property in the vicinity.

DAMS.

In the case of new dams, provision must be made for a stable structure on proper foundations and of a design that will give an ample spillway to care for times of flood. Flowage rights must be secured so that private property may not be damaged.

BULKHEADS.

Protection of property along the shore of Lake Michigan is necessary to hold ownership of the land as land eroded is lost to the owner. To avoid loss, piers and bulkheads are constructed in such manner as to cause accretions which in turn aids in lessening the damage of loss. Protection of their present holdings is thus secured, but the accretions belong and are a benefit to the public.

SHORE WALLS.

Along many of the inland lakes and streams where land values are increasing and owners are taking an interest in beautifying their property the Department, upon request, has established shore or limit lines beyond which no encroachment may be made. Upon these lines proper walls may be constructed, under permits granted, and the land improved in a manner to suit the individual taste. This aids in preventing encroachment on the flood plane of streams and gives the owner an added interest and pride in the entire shore line.

DREDGING.

In the Fox River and tributary lakes many owners have dredged along the low swampy shores and sloughs, throwing the excavated material on shore, thus removing unsightly weeds and grass, draining mosquito breeding grounds, improving the appearance of their individual holdings and setting a good example for other property owners. Where channels are excavated from the shore line into surrounding property these new channels become public waters under the terms of the State permit issued to and accepted by the property owner.

PIERS.

Temporary wooden piers are permitted in the interest of those using boats and all are under control of this Division so that none may become an obstruction to navigation.

DRAINAGE DISTRICTS.

Drainage Districts are given permits after their plans are approved. This control is necessary to the end that a safe and sane plan of public improvement may be had to the best interest of all directly or indirectly concerned.

Lack of prior control over levee construction by drainage districts resulted in a disastrous flood in 1922 on the Illinois River. In 1921 the authority of the Department was extended to cover this class of work. Previous to this enactment, if a drainage district wanted to do anything, all they required was the approval of the County Court. There was no State authority with engineering knowledge to control construction.

DOCK REPAIRS.

Keeping docks in repair along navigable streams aids in the maintenance of the dredged channel. It also increases the storage capacity of the dock and the yards in connection with same. Hence all permits for that class of construction is given special attention in order that no delay may occur in passing on the applications. The State co-operates with the citizens in all forms of legitimate improvements and acts in a supervisory manner that is to the advantage of all. Permits are granted without cost to the applicant, other than that of presenting a plan showing of what the proposed construction consists, the application to be explanatory of the plans.

COMPLAINTS.

The most numerous violations of the laws of the State are that of pollution of streams from sewage, drainage from coal mines and oil wells and also factory wastes. During the past fiscal year ten new cases have been investigated, where there has been more or less delay in securing the co-operation of the parties at fault. Especially has this been difficult in cases

of trade wastes, where new methods have had to be devised to suit the individual requirements and to get these methods installed. In several instances old violations have had to be investigated repeatedly to see that there are no recurrences of former conditions.

Obstructions to or encroachments on streams have been numerous, of which there were fifteen that required considerable effort and time to correct. Where industrial plants are located along or near a stream there is a strong temptation to dump refuse along the banks until the unoccupied space is filled and then continue even after the refuse begins to slide over the bank, forming an obstruction to the flood plane of the stream. In many cases the offenders, after having their attention called to this unlawful practice, will desist and remove the filling so placed.

It is possible for the Division to make satisfactory adjustments in most cases. Occasionally a hearing by the Division is necessary. The Attorney General is called upon to act in cases of flagrant violation to impose penalties provided by law.

Parties have concluded that if the permission of the "Illinois Commerce Commission" has been obtained authorizing the construction of a dam in a public stream, that they do not require a permit from the Department of Public Works and Buildings before constructing same. This would be in violation of the existing law and would, if insisted upon, come in conflict with this Division, as the law requires submission of plans and a permit for construction of dams in any water course. The Division, to prevent floods, has designed various types of dams, and the public is given this valuable information when it is requested in any case under consideration. (Note—October 28, 1924, the State Supreme Court decided an order of the Illinois Commerce Commission authorizing construction of a dam in a stream and power to a corporation to condemn property for the purpose, was without force and effect and that the Commerce Commission was without authority to act in such cases.)

ILLINOIS AND MICHIGAN CANAL.

The Illinois and Michigan Canal affords the only water connection at the present time between Joliet and the navigable waters of the Illinois River at LaSalle. A number of boats navigate this canal annually, although there is not much in the way of actual commerce carried, the size of the Canal and of its locks being such as to restrict the size of fleets which can navigate.

Flood damage in the fall of 1923 required some unusual expenditure. The 1924 season has been a very expensive one as to maintenance because of the almost continuing rains from the time the Canal opened for navigation in March to the close of the year, June 30, 1924. In consequence expenditures have increased $4,305.08 over a year ago. Receipts have decreased $643.34 but there is a balance on hand of $9,519.59 more than the balance of a year ago. Because of the floods and high water conditions receipts from the locks in the Illinois river have decreased for the reason boats navigating the river have been able to go over the dams instead of through the locks. (Note: On August 8, prior to the writing of this report, there was excessive rainfall and floods, resulting in great amount of damage to the Canal from Ottawa west to LaSalle. Banks were washed out at many places. At some points the road bed of the Rock Island Railway along the Canal was washed into and filled the entire channel of the Canal. As a result the Canal from that date has not been usable and extraordinary expenditure will be entailed in excavation of the channel and repairs to banks.)

New bridges across the Canal are being constructed at LaSalle and at Seneca. At the latter point LaSalle County and the Village of Seneca joined with the State in meeting the expense.

During the month of July, 1924, the largest draft boat which ever attempted to navigate the Canal was taken through. This boat had a draft of 7½ feet which was reduced to 5 feet 2 inches. This was much in excess of the draft afforded by the Canal but by resort to various devices it was

taken through. On July 15 a fleet of 20 steel pontoons, each being 50 feet long, was taken through the Canal for the U. S. Government. This is the largest fleet of which there is any record of ever navigating the Canal. The accompanying pictures of boats and fleets will give a better idea of the water navigation afforded by this old Canal, notwithstanding the impression prevailing that it is of no value and no public use.

Following is a statement of receipts, expenditures, number of boats passing through the Canal and principal articles transported:

SUMMARY SPECIAL CANAL FUND AND ACTIVITY REPORT.

July 1, 1923 to June 30, 1924.

Balance on hand July 1, 1923		$39,750.75
Receipts July 1, 1923 to June 30, 1924	$40,973.13	
Expenditures July 1, 1923 to June 30, 1924	31,453.54	
Receipts over expenditures	$ 9,519.59	9,519.59
Balance on hand July 1, 1924		$49,270.34

RECEIPTS.

July 1, 1923 to June 30, 1924.

90 foot strip, lots and bridge rentals	$15,910.47
Water power rentals	15,155.76
Boat house rentals and level licenses	87.50
Water pipe rentals and miscellaneous	6,930.19
Ice leases	847.00
Certified copies	20.00
Tolls and lockages	638.88
Quit Claim Deed	383.33
Total	$40,973.13

EXPENDITURES.

July 1, 1923 to June 30, 1924.

From canal appropriation	$31,453.54
From river appropriation	12,312.79
From Bridge at Ottawa appropriation	5,000.00
From Bridge at Lockport appropriation	6,496.00
From Bridge at LaSalle appropriation	2,169.05

Number of boats running, clearances issued, tolls and lockage collected, and tons transported on the Illinois and Michigan Canal and through Henry and Copperas Creek Locks for period July 1, 1923 to June 30, 1924:

	Copperas Creek.	Henry.	Joliet.	Ottawa.	Total.
Tolls and lockages	$229 15	$144 57	$235 54	$29 62	$638 88
Boats cleared	94	48	85	24	251
Number of passengers			18		18
Tons transported	16,830	7,610	374	52	24,866

Statement of the principal articles transported upon the Illinois River, cleared at Collector's office at Locks, at Henry and Copperas Creek, for the year ending June 30, 1924:

Articles.	Measure.	Copperas Creek.	Henry.	Total.
Corn	Bushels	5,900	30,900	36,800
Wheat	Bushels	148,700	29,500	178,200
Oats	Bushels	.....	12,000	12,000
Coal	Tons	7	33	40

BEARDSTOWN FLOOD PROTECTION.

The 53rd General Assembly made an appropriation of $350,000 to "widen, raise, strengthen, improve, repair, build and construct, as the case may be, levees around the city of Beardstown for the purpose of furnishing protection from floods and overflow of the Illinois River." This appropriation was made to the Department of Public Works and Buildings. Beardstown has a population of 7,000 or more. It is situated on the Illinois River nine miles below the Sangamon River. At this point the valley has a minimum width of six miles for a stretch of twenty-five miles below the mouth of the Sangamon River. In the past twenty years levee operations for reclamation of agricultural areas in the seventy miles just below Beardstown have been active and at present the greater portion of the bottom land area has been reclaimed. Flood discharges in this valley, which formerly spread over a territory several miles in width, are now confined to a narrow channel between the levees which are built along both banks. Immediately below Beardstown levees have been constructed which leave a width of less than 1,500 feet for the channel of the Illinois River. The effect of the levee construction is shown by comparison of the floods of 1904 and 1922 which were practically of the same volume. The former reached an elevation of 446.8 Memphis datum, whereas the latter was 5.4 feet higher. Alvord and Burdick, engineers, in their report on the "Illinois River and its Bottom Lands" have tabulated the "flood expectation" at Beardstown based on the Fuller frequency formula, and conclude that we may expect a flood of 148,000 c. f. s., or thirty-five per cent greater than that of 1904 in a period of fifty years. Such a flood as indicated on the 1922 rating curve, (plate one) Flood Report of the Division of Waterways for 1922, would rise to an elevation slightly less than 455 Memphis datum.

The appropriation of $350,000 was made with a view to protecting the city of Beardstown up to an elevation of 455 feet Memphis datum by the construction of walls and levees either completely surrounding the city or run along the river front and thence to the high ground back of the city. The Division of Waterways was allotted the task of making necessary surveys to ascertain estimates of cost. The people of Beardstown were not a unit upon the plan to be followed. Therefore, surveys were made for four different plans. The engineering estimates for the various plans range from $362,200 to $630,100. None of these estimates include construction of sewers and sewage pumping plants, it being expected the city of Beardstown will take care of this expense. The project costing $362,200 is $12,200 in excess of the appropriation made and this estimate of cost is based upon the assumption that if this project is accepted by the people of Beardstown the Chicago, Burlington and Quincy Railroad Company and the Baltimore & Ohio Railroad Company will, at the expense of these companies, raise these tracks to elevation 455 Memphis datum, so that there will be no inflow over their tracks. Should the railroad companies decline to cooperate in the plan of construction proposed, the estimate of cost would be much higher and the work cannot be completed within the amount of the appropriation provided. Whether the city of Beardstown will meet any difference between the cost of this work and the appropriation, has not at the time of the writing of this report been determined, nor have the people of the city of Beardstown indicated which project is acceptable from the local point of view. The detailed Engineer's report follows:

July 26, 1924.

To L. D. Cornish, Acting Chief Engineer, Division of Waterways:

REPORT ON BEARDSTOWN FLOOD PROTECTION.

HYDRAULICS.

The City of Beardstown with a population of 7,000 or more, is situated in the Illinois River Valley nine miles below the Sangamon River. Here the valley has a minimum width of six miles for a stretch of 25 miles below the mouth of the Sangamon River.

In the past twenty years levee operations in the 70 miles just below Beardstown have been very active, until at present the greater portion of the bottom land area has been reclaimed. Flood discharges in this valley, which formerly spread over a territory several miles in width, are now confined to a narrow channel between the levees which are built along both banks. Immediately below Beardstown this width is less than 1,500 feet.

The effect of the levees is shown by a comparison of the floods of 1904 and 1922, which were practically of the same volume. The former reached an elevation of 446.8 Memphis Datum, whereas the latter was 5.4 feet higher.

Alvord and Burdick, Engineers, in their report on the "Illinois River and its Bottom Lands" have tabulated the "Flood Expectation" at Beardstown, based on the Fuller frequency formula, and conclude that we may expect a flood of 148,000 c. f. s., or 35% greater than that of 1904, in a period of fifty years. Such a flood, as indicated on the 1922 rating curve (Plate 1), would rise to an elevation slightly less than 455 feet Memphis Datum.

PROPOSED PROTECTION.

It is proposed to protect the City of Beardstown from floods and the overflow of the Illinois River up to an elevation of 455 feet Memphis Datum, by the construction of a system of walls and levees either completely surrounding the city or running along the river front and thence to the high ground back of the city.

APPROPRIATIONS.

House Bill No. 299, passed by the 53rd General Assembly, carried an appropriation of $350,000 to "widen, raise, strengthen, improve, repair, build and construct, as the case may be, levees around the City of Beardstown in the State of Illinois for the purpose of furnishing protection from floods and overflow of the Illinois River."

ESTIMATES OF COST (ESTIMATES NO. 1 TO NO. 6).

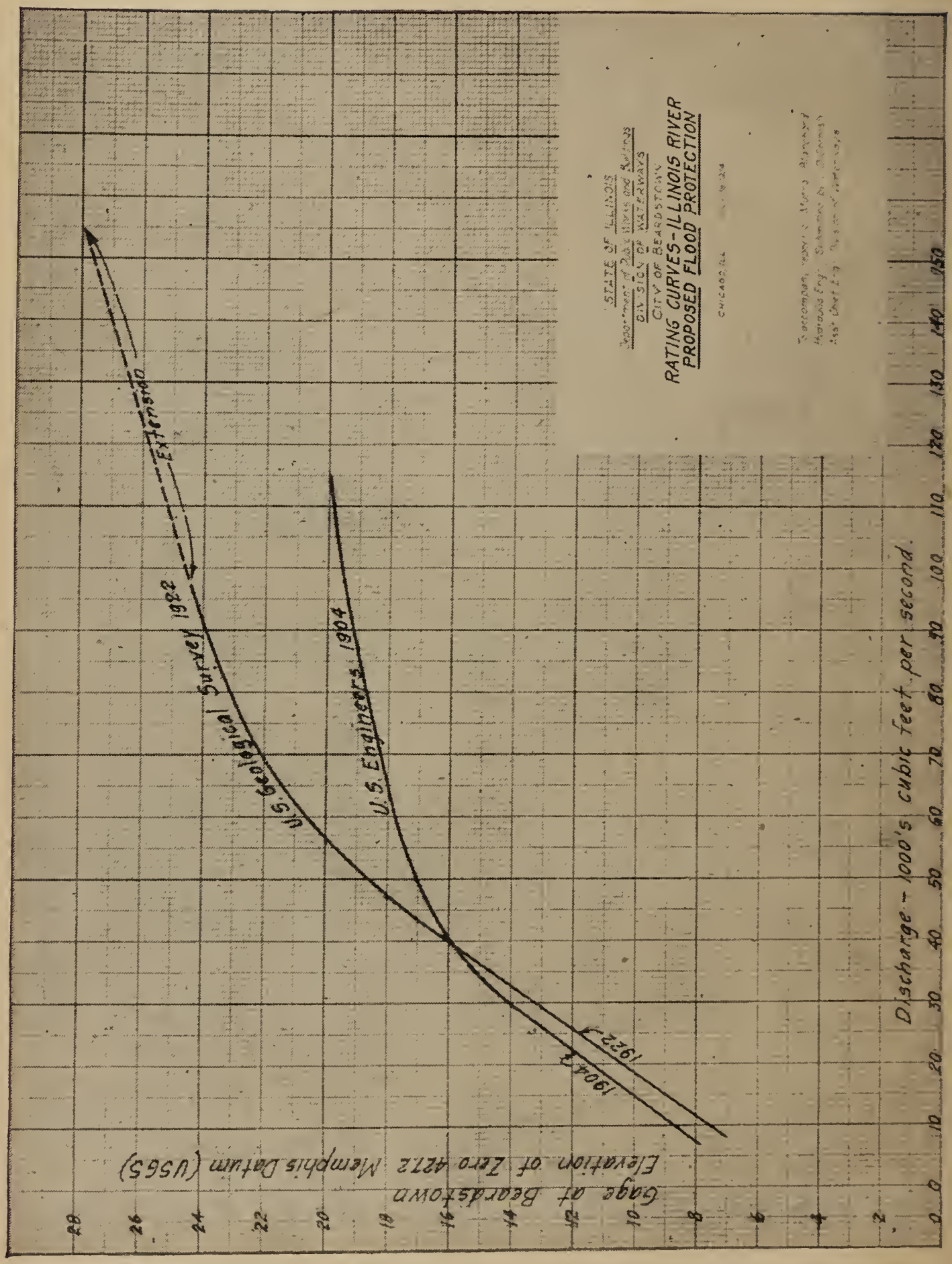
Project No. 1	$362,200
Alternate No. 1A	380,700
Project No. 2	393,600
Alternate No. 2A	412,000
Project No. 3	396,500
Project No. 4	630,100

None of these estimates include an item for the construction of sewers and sewage pumping plants. It is proposed that the city stand this cost.

All of the estimates include an item of 15% of the cost of construction for Engineering and Contingencies. Contingencies might be necessary to cover such items as unforseen right of way damages or additional cost caused by the encountering of quicksand along the river front, or of poor foundation material in the marshes back of the city.

Estimates for Projects No. 1 and No. 1A are based on the assumption that the Chicago, Burlington and Quincy and the Baltimore and Ohio Railroad Companies will at their expense raise their tracks to elevation 455 Memphis Datum so that there will be no inflow over the tracks. Should they refuse to cooperate, estimates for Projects No. 2 and No. 2A would supersede those for Projects No. 1 and No. 1A respectively.

Plate 1.


STATE OF ILLINOIS
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
RATING CURVES-ILLINOIS RIVER
PROPOSED FLOOD PROTECTION
CHICAGO, ILL.
Extension
1922
1904
U.S. Geological Survey
U.S. Engineers 1904
1904
1922
Gage at Beardstown
Elevation of Zero 427.2 Memphis Datum (USGS)
Discharge - 1000's cubic feet per second.
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

The prices used in making these estimates are generally higher than those used by the local engineers employed by the City of Bardstown. Should lower prices than those here used be obtained when bids are called for, and should the right of way damages not exceed those estimated, so that the contingency item could be reduced, it is probable that all of the estimates, except for Project No. 4, might come within the amount appropriated.

PROJECTS.

No. 1. Contemplates raising Main Street, where it is low, to elevation 455 Memphis Datum, from 360 feet west of Clendenning Street to 100 feet west of Jackson Street; constructing, from this point, a concrete wall (except for openings at street intersections) along the center line of Main Street to the west curb line of LaFayette Street; turning to the left and running the wall northerly along the said curb line, 218 feet, to a point in the Illinois River on the river front; turning here to the right and continuing the wall easterly, near the shore line, in the direction of the northwest corner of Shell's Garage to a point in the west side of State Street 10 feet west of the said garage corner (leaving a 22-ft. opening in State Street); turning to the left and running the wall northerly, parallel to the center line of State Street, 35 feet; turning here to the right and running the wall easterly 2,070 feet to a point distant 165 feet from the north property line of Main Street, 160 feet east of the west line of Edwards Street. From this point it is proposed to construct a levee around the city, as shown on Plate 2, to the raised street at Clendenning and Main Streets.

No. 1A. This is the same as Project No. 1 except that for the course farthest south in Ravenswood there is substituted three courses taking in this subdivision south to State Street. (Plate 3.)

No. 2. Contemplates the same construction as Project No. 1 except that it is assumed that the Railroad Companies refuse to cooperate and there is necessitated the construction of walls and levees along both sides of the railway properties north of 15th Street to the high ground in the vicinity of 6th and 7th Streets. (Plate 4.)

No. 2A. This is the same as Project No. 2 except that the same substitution is made as in Project No. 1A to include the Ravenswood subdivision south to South Street. (Plate 5.)

No. 3. Contemplates the same construction as Project No. 1 from Clendenning and Twelfth Streets along the west, north and east sides to the knoll southeast of Oak Grove Cemetery. From Clendenning and Twelfth Streets it is proposed to construct a levee south to the knoll which extends westward from Garden Street and Grand Avenue, raise Grand Avenue and Meredosia to elevation 455 feet Memphis Datum from Garden Street and Grand Avenue to the southeast corner, N. E. ¼, S. W. ¼, Sec. 22. From this point a levee will extend to the high ground at the southeast corner of Sec. 22. On the east side a levee will extend from the knoll southeast of Oak Grove Cemetery southeasterly to the high ground at Fairview Heights. (Plate 6.)

No. 4. Contemplates the construction of levees and a concrete wall on the route proposed by the local engineers employed by the City of Beardstown. Their plan proposed to extend the South Beardstown and the Lost Creek Levees to the high ground back of town, to raise these levees and to connect them along the river front with a concrete wall 2,600 feet long in the city limits and levees the balance of the distance. (Plate 7.)

CONFERENCE.

A conference was held at Beardstown with some of the leading business men interested in the project on March 11 of this year, at which there were suggested various schemes that citizens of Beardstown desired to have considered. In an endeavor to give these people the most satisfactory protection and to comply with specifications of the law, the projects here described were investigated.


PLATE 2
ROAD
ILLINOIS
WOOD ST.
HUSCOOTEN
BAY
DISTRICT LEVEE
MEYER POND
SEA WALL
LOST CREEK DR.
CHANNEL
BEARDSTOWN
CITY OF
CITY OF BEARDSTOWN FARM
DITCH
PROPOSED LEVEE
PROPOSED LEVEE
WOOD
RAVENS
MEREDOSIA ROAD
BOULEVARD ROAD
C. B. & Q. R.R.
FARM
CEM
STATE OF ILLINOIS
Department of Public Works and Buildings
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
PROJECT No. 1
PROPOSED FLOOD PROTECTION

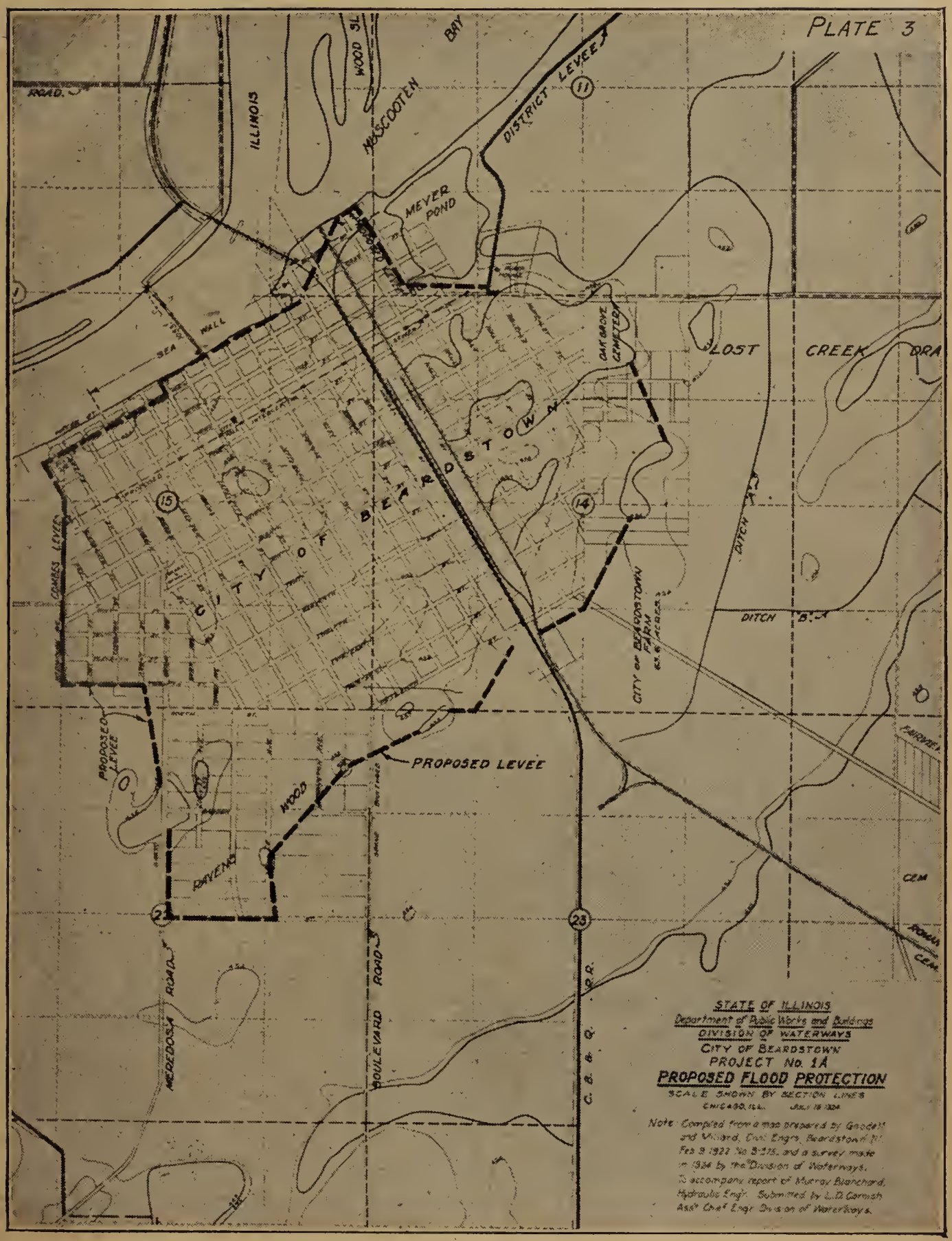


PLATE 3
ILLINOIS
WOOD ST.
BAY
MUSCOOTEN
DISTRICT LEVEE 11
MEYER POND
SEA WALL
OAK GROVE CEMETERY
LOST CREEK DRA
BEARDSTOWN
CITY OF BEARDSTOWN
15
14
DITCH
DITCH B-A
CITY OF BEARDSTOWN FARM 65.6 ACRES
PROPOSED LEVEE
PROPOSED LEVEE
HOOD
DRIVE
21
23
MEREDOSIA ROAD
BOULEVARD ROAD
C. B. & Q.
FAIRVIEW CEM
ROMAN CATH. CEM
STATE OF ILLINOIS
Department of Public Works and Buildings
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
PROJECT No. 1A
PROPOSED FLOOD PROTECTION
SCALE SHOWN BY SECTION LINES
Note: Compiled from a map prepared by Goodell and Willard, Civil Engrs. Beardstown Ill. Feb 3 1922 to 3-275, and a survey made in 1934 by the Division of Waterways. To accompany report of Murray Blanchard, Hydraulic Engr. Submitted by L. D. Carmichael Asst. Chief Engr. Division of Waterways.

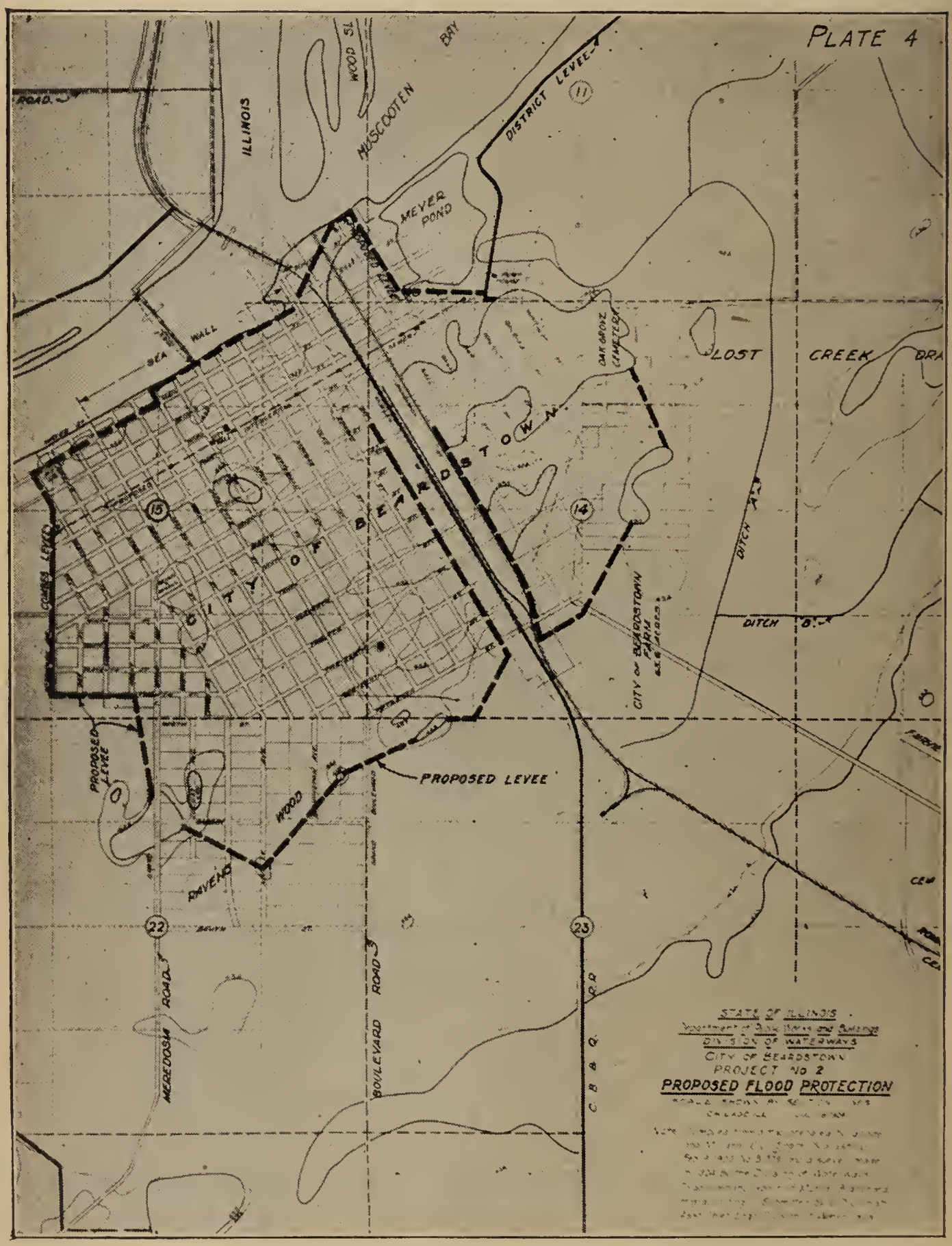


PLATE 4
ILLINOIS
WOOD ST.
BAY
NIPPERSCOTTEN
DISTRICT LEVEE
MEYER POND
SEA WALL
OAK GROVE CEMETERY
LOST CREEK
DRA
BEARDSTOWN
CITY OF
CITY OF BEARDSTOWN PARK
DITCH
DITCH
PROPOSED LEVEE
PROPOSED LEVEE
WOOD
RIVER
MEREDOSIA ROAD
BOULEVARD ROAD
C B & Q R.R.
CEM
STATE OF ILLINOIS
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
PROJECT No 2
PROPOSED FLOOD PROTECTION

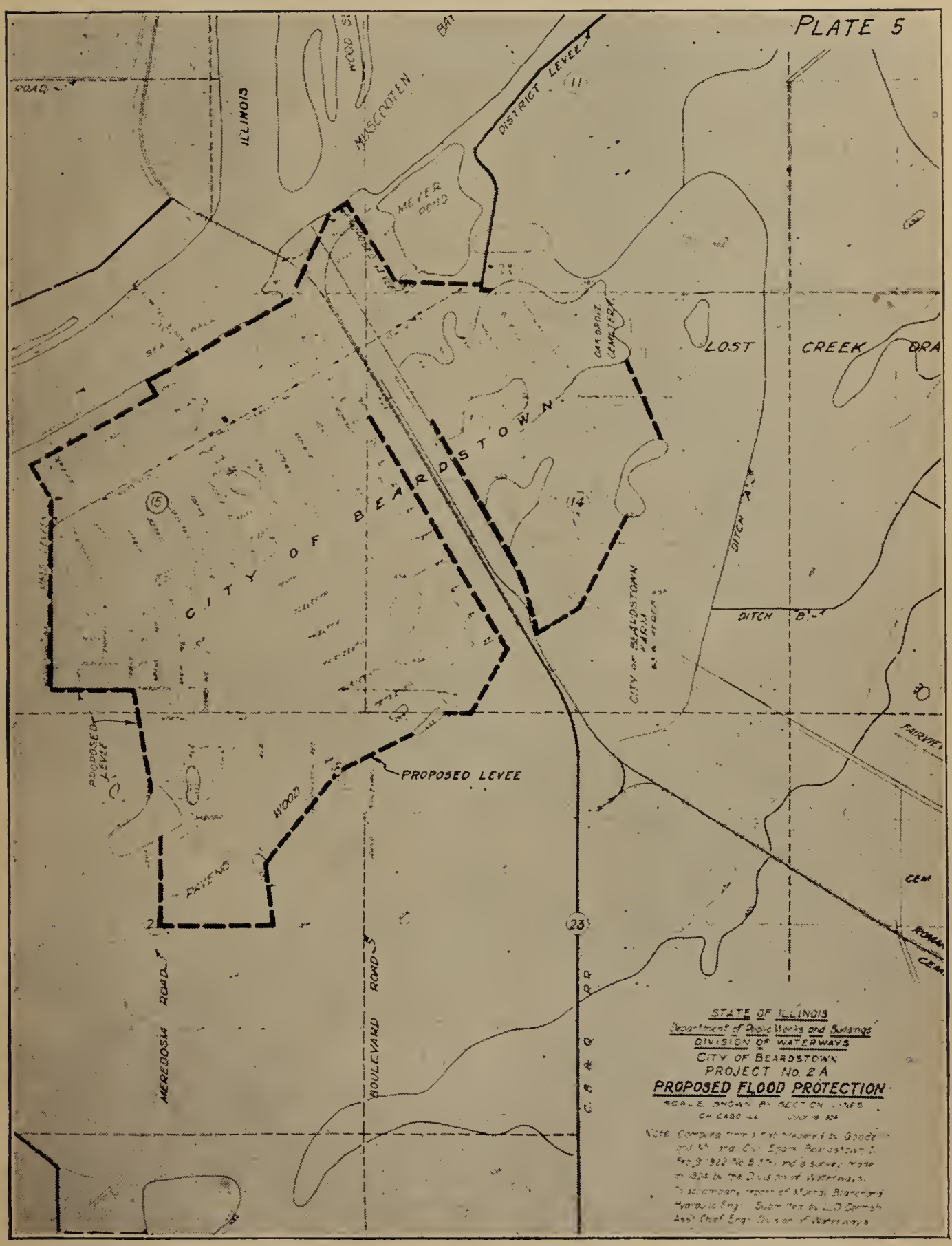


PLATE 5
ILLINOIS
MASCOUTEN
WOOD ST
BAI
DISTRICT LEVEE
MEYER POND
LOST
CREEK
DRA
CITY OF BEARDSTOWN
DITCH
PROPOSED LEVEE
WOOD
MEREDOSIA ROAD
BOULEVARD ROAD
C B & Q R R
FAIRVIEW
CEM
STATE OF ILLINOIS
Department of Public Works and Buildings
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
PROJECT No. 2 A
PROPOSED FLOOD PROTECTION

SURVEY.

During March and April of this year a survey was made of the various projects to obtain the necessary data for determining the most feasible route and estimates of the cost of construction.

All of the projects were completely cross-sectioned. Soundings were taken along the river front and in Myers Pond. Topography was taken on either side of the base line for the courses around the city. All of the cross-sections and the topography have been plotted.

Photographs of buildings and other topographic features were taken along the various routes.

MATERIAL.

On the Woermann maps of the Illinois River (1904 survey) there are recorded the results of borings made in the river bed. Three of these were made along the river front at and near Beardstown; they are as follows:

Boring number.	Distance off shore (feet).	Location.	Material.
185	100	Opposite the Upper end of South Beardstown levee.	12 ft. mud, sand and clay. 13 ft. sand and gravel.
186	70	Foot of Marsh Street.	15 ft. sand. 12 ft. gravel. 12 ft. sand.
187	100	Opposite lower end of Muscooten Bay.	8 ft. sand. 14 ft. sand and shells. 10 ft. sand.

The South Beardstown and the Lost Creek Levees are built of sandy material and indicate the kind of material that will be encountered in these localities and for the raising of the levees.

The surface of the ground is sandy all around the town.

It thus appears that the material to be encountered is sandy and similar to that in the South Beardstown and Lost Creek Levees.

Material for backfill behind the concrete wall can be obtained along the right bank opposite Beardstown and transported by scow across the river.

DESIGN.

The concrete wall section adopted for this estimate is shown on Plate 8 (1). No provision is made for a sewer in the wall because the wall is not continuous (an opening is provided at State Street) and it does not extend along the river front below LaFayette Street.

The levee section, Plate 8 (2), has a crown of 10 feet and slopes of 1 on 3 each side.

Where existing levees are to be raised and strengthened the adopted section is set back of the old levee so as to make the side slope effective from a tangent to the side of the borrow pit up to the crown. Plate 8 (3).

RIGHT OF WAY.

A strip of land wide enough to include the levee and borrow ditch will be required around the city. The proposed wall as routed will require the purchase of some private property along the river front.

MAINTENANCE.

This item is not included in the estimates. It is assumed that the city will maintain the walls, levees and pumping plant.

In Project No. 4 it will be necessary for the City and the Commissioners of the Levee Districts to agree as to the responsibility for the levees at the boundaries of the districts.

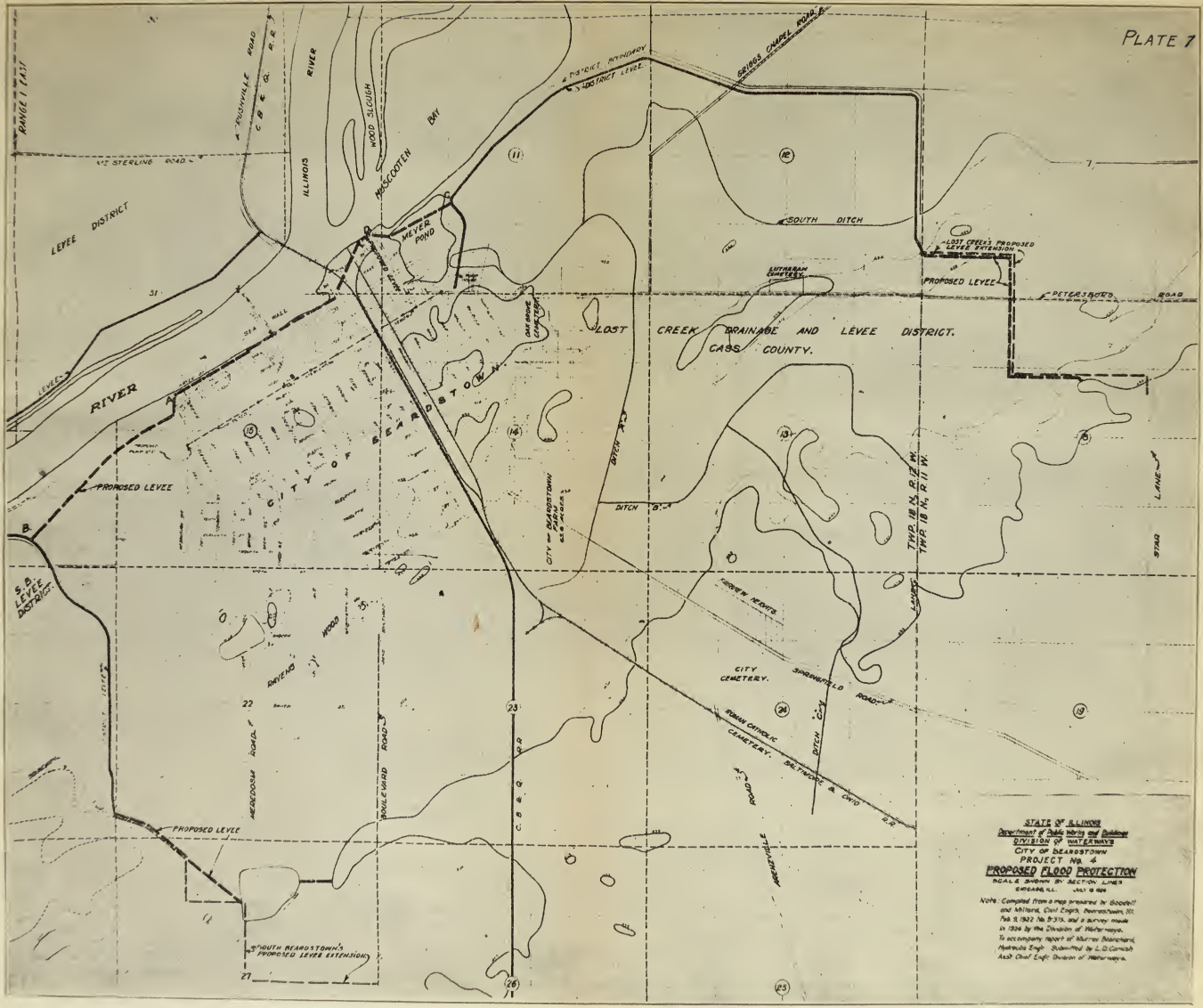


PLATE 1
RANGE 1 EAST
LEVEE DISTRICT
ILLINOIS
RIVER
MUSCOTEN BAY
WOOD SLOUGH
MEYER POND
SPRIGG'S CHAPEL ROAD
SOUTH DITCH
LOST CREEK'S PROPOSED LEVEE EXTENSION
PROPOSED LEVEE
PETERSBORO ROAD
LOST CREEK DRAINAGE AND LEVEE DISTRICT.
CASS COUNTY.
LUTHERAN CEMETERY
OAK RIDGE CEMETERY
CITY OF BEARDSTOWN
CITY OF BEARDSTOWN ELEVATOR
DITCH A-3
DITCH B-4
TWP. 18 N., R. 12 W.
TWP. 18 N., R. 11 W.
STAG LANE
BROWN HEIRS
CITY CEMETERY
SPRINGFIELD ROAD
ROMAN CATHOLIC CEMETERY
BALTIMORE & OHIO R.R.
BOULEVARD ROAD
MENDOTA ROAD
RAILROAD
S.B. LEVEE DISTRICT
PROPOSED LEVEE
SOUTH BEARDSTOWN'S PROPOSED LEVEE EXTENSION
STATE OF ILLINOIS
Department of Public Works and Buildings
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
PROJECT No. 4
PROPOSED FLOOD PROTECTION
SCALE SHOWN BY SECTION LINES
CHICAGO, ILL. JULY 8 1924
Note: Compiled from a map prepared by Goodell and Millard, Civil Engrs, Beardstown, Ill. Feb 3, 1922 No 5-315, and a survey made in 1924 by the Division of Waterways.
To accompany report of Morrow Beardsley, Hydraulic Engr. Submitted by L.D. Comish Asst Chief Engr. Division of Waterways.

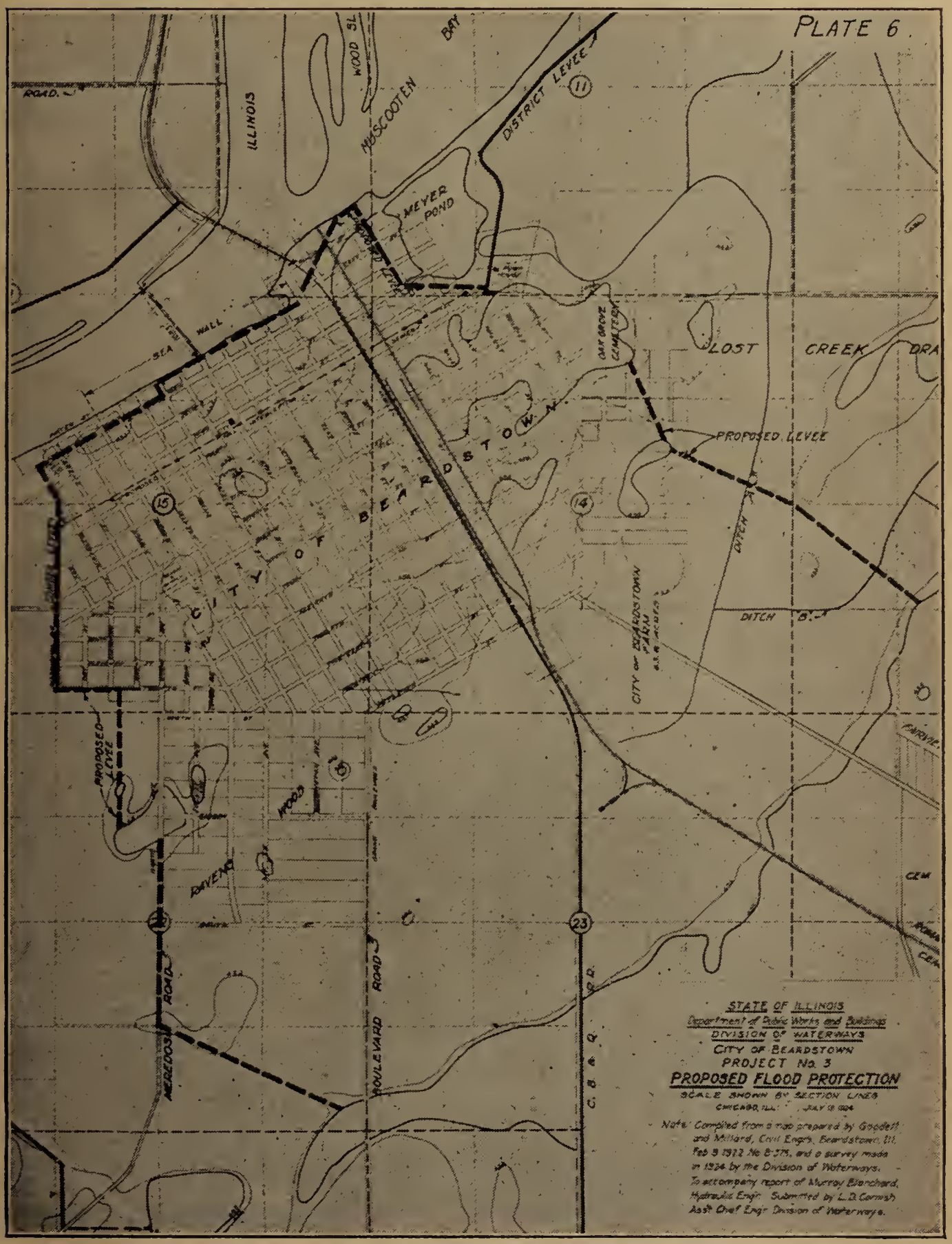
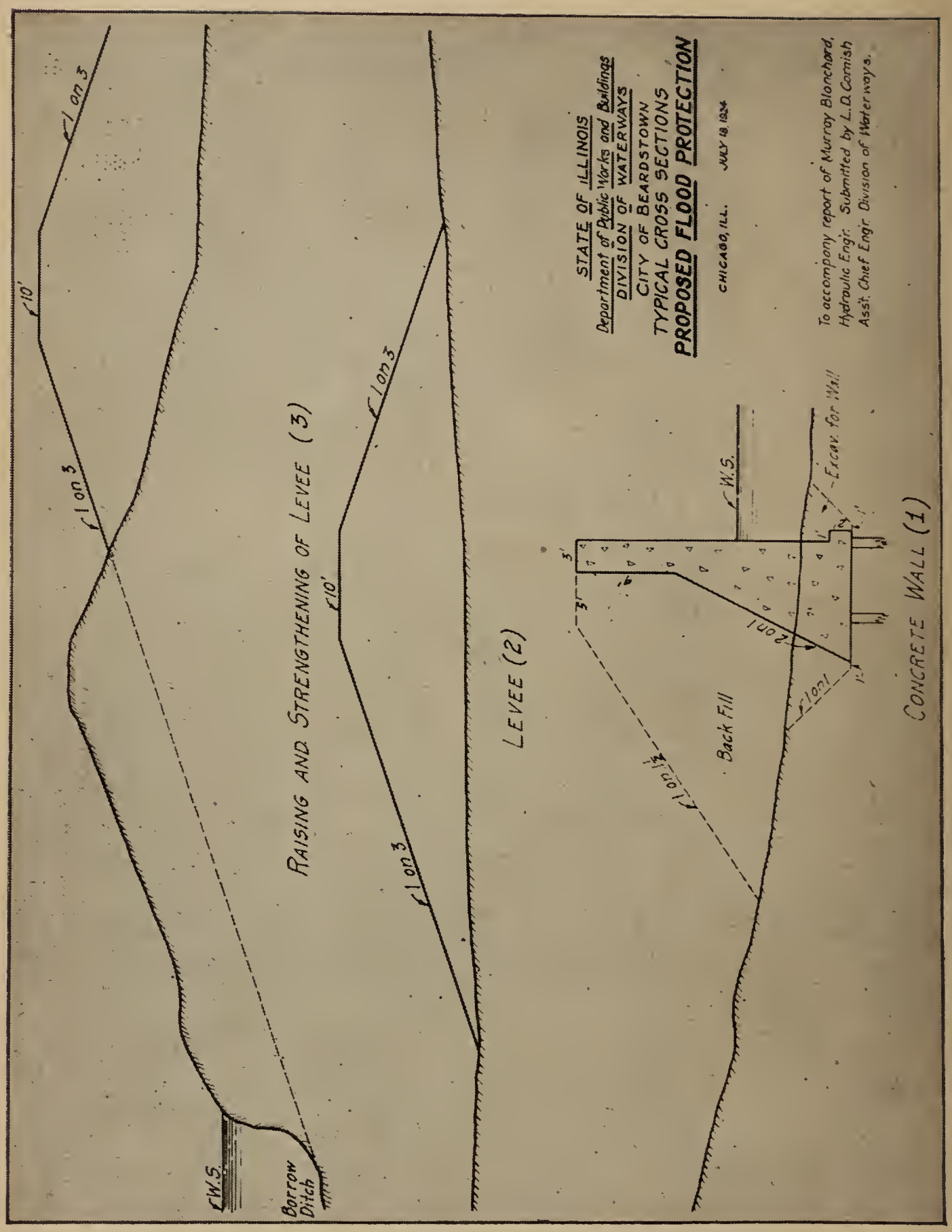


PLATE 6.
ILLINOIS
WOOD ST.
MUSCOOTEN BAY
DISTRICT LEVEE
MEYER POND
SEA WALL
OAK GROVE CEMETERY
LOST CREEK DRA
PROPOSED LEVEE
CITY OF BEARDSTOWN
DITCH
CITY OF BEARDSTOWN PARK
PROPOSED LEVEE
ROAD
RIVER
ROAD
BOULEVARD ROAD
C. B. & Q. R.R.
CEM
STATE OF ILLINOIS
Department of Public Works and Buildings
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
PROJECT No. 3
PROPOSED FLOOD PROTECTION
SCALE SHOWN BY SECTION LINES
CHICAGO, ILL., JULY 8 1924
Note: Compiled from a map prepared by Goodell and Millard, Civil Engrs. Beardstown, Ill. Feb 3 1913 No 8-375, and a survey made in 1924 by the Division of Waterways.
To accompany report of Murray Blanchard, Hydraulic Engr. Submitted by L.D. Cornish Asst. Chief Engr. Division of Waterways.

Plate 8.


STATE OF ILLINOIS
Department of Public Works and Buildings
DIVISION OF WATERWAYS
CITY OF BEARDSTOWN
TYPICAL CROSS SECTIONS
PROPOSED FLOOD PROTECTION
CHICAGO, ILL. JULY 18, 1924
To accompany report of Murray Blanchard, Hydraulic Engr. Submitted by L.D. Comish Asst. Chief Engr. Division of Waterways.
RAISING AND STRENGTHENING OF LEVEE (3)
LEVEE (2)
CONCRETE WALL (1)
Borrow Ditch
Back Fill
Excav. for Wall
H.W.S.
1 on 3
1 on ½
10'
3'
5'

PUMPING.

In the estimate for Project No. 4 there is an item of $50,000 for pumping. Here again an agreement is required between the City and the Levee District Commissioners to determine the proportionate amount of the pumping that each will be responsible for. On this agreement will depend the layout required for pumping equipment.

In Project No. 3 there is a drainage area of three square miles on the high ground back of the city, the run off from which will enter the project area. An item has been included to take care of a small pumping plant for this purpose.

CONCLUSION.

Projects No. 1 and No. 2 and the Alternate Projects No. 1A and No. 2A do not permit of an opportunity for the City to expand beyond the present limits. Project No. 4 encloses a large territory but the cost is prohibitive. Project No. 3 costs but little more than Project No. 1 and No. 2, but it provides an additional area (including the marsh) 80% as large as the present city area.

(Signed) MURRAY BLANCHARD,
Hydraulic Engineer.

REPORT ON PECATONICA RIVER FLOOD PROTECTION AT AND BELOW FREEPORT SURVEY AND REPORT BY W. G. POTTER, DRAINAGE ENGINEER.

INTRODUCTION.

The Pecatonica River rises in the southwestern part of Wisconsin. Its headwaters are in the hills of that region, subject to sharp rises and falls due to those hills. It flows southeasterly into Stephenson County, Illinois and then turns east and northeast through Stephenson and Winnebago counties and finally outlets into the Rock River at Rockton.

The principal tributaries in Illinois are the Yellow Creek, entering a few miles east of Freeport, the Little Pecatonica entering west of the village of Pecatonica and Sugar River entering between Harrison and Shirland.

The watershed area of the Pecatonica at its mouth is about 2,610 square miles of which 730 miles are in Illinois. The watershed area at and above Freeport is 1,330 square miles.

The upper reaches of the river, especially in Wisconsin are as mentioned above, quite hilly, the fall from source to the mouth (158 miles) being about 500 feet. In the 62 miles from Freeport to the mouth however, the fall is only about 34 feet. Therefore in times of heavy rain, the flood waters come down to Freeport quickly and are suddenly obstructed by the flat grades below there. This causes the banks to overflow and flood the low-lands of the valley. It is estimated that from 32,000 to 40,000 acres of good land are in this way subject to overflow and loss of crops. Not only is agricultural land subject to these periodic overflows, but also East Freeport, the main manufacturing part of Freeport has been overflowed time and again by these high waters. See photographs 1 to 4 herewith. For this reason an appropriation was made by the last legislature for a survey to develop methods and feasibility of flood protection. This survey was consequently started about June 1, 1924 and lasted until October 1st. The survey and report takes up the question in two parts, first the protection of Freeport and second, the straightening and cutting off of bends and crooks in the river below Freeport. All elevations given in this report or on profiles are with reference to sea level datum.

No. 1. Henderson Avenue North of Ash Street at Freeport in 1922 Flood.

No. 2. Looking North from Intersection of C. & N. W. and C. M. & St. P. tracks at Freeport in 1922 Flood.

An outline of the report is as follows:

Introduction.

1. Rainfall.
2. Probable floods and frequency.
3. Run off and discharge.
4. The Freeport problem.
    a. Present situation.
    b. Condition of the river.
    c. Railroads and bridges.
    d. Proposed change in river.
        Project A.
        Project B.
        Project C.
    e. Recommendations.
5. The river below Freeport.
    a. Present condition
    b. Dams.
    c. Bridges.
    d. Cut-offs.
    e. Recommendations.
6. Conclusion.

1. RAINFALL.

For the purpose of getting an idea of the amount and frequency of storm periods in the Pecatonica valley, a study has been made of the rainfall at several towns situated in the watershed. These towns are Dodgeville, Wisconsin, located near the extreme north edge of the watershed, Darlington, Wisconsin, further south, Mt. Horeb, Wisconsin, located near the northeast border of the watershed on the headwaters of Sugar River, Brodhead, Wisconsin, further south on the same tributary, and Freeport in Stephenson County, Illinois. These records were taken from the U. S. Weather Bureau reports and cover all the time in which records have been kept at those places.

On the accompanying chart, plate 1, the monthly rainfall is given at each of the above towns. Also the monthly mean of the same towns is shown for the whole period and at the top is given the mean of the five towns for each month of the year.

From this record we derive the following information:

FREEPORT.

Eighteen times in 15½ years the monthly record has exceeded five inches and eight times it has exceeded 7½ inches, the maximum being 9.95 inches in September, 1916. At Dodgeville in four years the monthly rainfall exceeded 5 inches seven times and exceeded 7½ inches three times, the maximum being 11.88 inches in September, 1915. At Brodhead in ten and one-half years the monthly rainfall exceeded 5 inches nineteen times and 7½ inches three times, the maximum being 8.96 in August, 1921. At Mt. Horeb in sixteen years the monthly rainfall exceeded 5 inches twenty-six times and 7½ inches seven times, the maximum being 9.79 inches in July, 1913. At Darlington in nineteen years the monthly rainfall exceeded 5 inches twenty-eight times and 7½ inches thirteen times, the maximum being 10.85 inches in September, 1915.

Thus the maximum monthly rainfall has only happened in two of the stations in any one month, that being September, 1915. Taking the average of the five towns for the time the records are available, we find that in the twenty-three and one-half years from March, 1901 to July, 1924, we have thirty-six times the monthly rainfall has been above 5 inches and eleven times it has exceeded 7½ inches, the three maxima being 9.16 inches in July, 1903, 9.42 in September, 1915 and 8.79 in August, 1921.

Taking these records another way and first finding the mean of each station for the Januarys, Februarys, etc., and then taking the mean of the five stations we have the mean rainfall falling over the watershed for each month of the year. It will be noted that these maximum rainfalls

No. 3. Henney Manufacturing Co., East Freeport, 1922 Flood.

No. 4. Commercial Avenue, East Freeport, in 1922 Flood.

EXCESSIVE STORMS IN PECATONICA RIVER VALLEY.
(From U. S. Weather Bureau.)

TABULATION 1.

Duration.	Depth.	Freeport, Jan., 1914-Aug., 1924.		Dodgeville, Jan., 1914-Oct., 1916.		Darlington, Jan., 1914-Aug., 1924.		Mt. Horeb, Jan., 1914-Aug., 1920.		Brodhead, Jan., 1914-Aug., 1924.		Average of all stations.	
		No. of storms.	Average depth.	No. of storms.	Average depth.	No. of storms.	Average depth.	No. of storms.	Average depth.	No. of storms.	Average depth.	No. of storms.	Average depth.
1 day.	2 inch	12	2.83	7	2.75	12	2.58	7	2.39	10	2.54	48	2.63
	3 inch	2	4.46	2	3.69	3	3.23			1	3.62	8	3.70
	4 inch	1	5.91	1	4.33							2	5.12
	5 inch	1	5.91									1	5.91
	Maximum		5.91		4.33		3.30		2.80		3.62		3.99
2 days.	2 inch	23	3.01	8	3.20	18	2.64	13	2.56	19	2.70	81	2.80
	3 inch	10	3.82	3	4.71	4	3.63	3	3.27	4	4.02	24	3.86
	4 inch	3	5.04	1	7.38	1	4.30			1	5.54	6	5.39
	5 inch	1	6.01	1	7.38					1	5.54	3	6.31
	6 inch	1	6.01	1	7.38							2	6.70
	Maximum		6.01		7.38		4.30		3.43		5.54		5.33
3 days.	2 inch	31	2.97	9	3.20	30	2.58	14	2.97	23	2.90	107	2.86
	3 inch	15	3.73	3	4.94	6	3.88	7	3.63	7	3.94	38	3.87
	4 inch	4	4.78	1	7.71	3	4.20	2	4.49	3	4.41	13	4.74
	5 inch	1	6.01	1	7.71					1	5.54	3	6.42
	6 inch	1	6.01	1	7.71							2	6.86
	Maximum		6.01		7.71		4.30		4.59		5.54		5.63
4 days.	2 inch	34	3.08	12	3.06	37	2.58	19	2.84	29	2.88	131	2.86
	3 inch	15	3.93	3	5.04	7	3.92	7	3.75	11	3.73	43	3.93
	4 inch	6	4.62	2	5.86	4	4.29	2	4.54	3	4.44	17	4.65
	5 inch	1	6.01	1	7.71					1	5.54	3	6.42
	6 inch	1	6.01	1	7.71							2	6.86
	Maximum		6.01		7.71		4.66		4.61		5.54		5.71
5 days.	2 inch	36	3.15	14	3.43	40	2.67	19	3.02	33	2.85	142	2.93
	3 inch	19	3.93	6	4.75	8	4.05	10	3.62	11	3.77	54	3.95
	4 inch	6	4.78	3	6.02	4	4.78	3	4.30	3	4.46	19	4.85
	5 inch	2	5.67	1	9.30	1	5.95			1	5.54	5	6.43
	6 inch	1	6.01	1	9.30							2	7.66
	Maximum		6.01		9.30		5.95		4.61		5.54		6.28
6 days.	2 inch	38	3.22	14	3.49	41	2.83	21	3.71	35	2.88	149	3.05
	3 inch	21	3.87	7	4.52	13	3.77	10	3.96	14	3.73	65	3.90
	4 inch	7	4.88	3	6.02	4	4.89	5	4.74	3	4.61	22	4.97
	5 inch	3	5.52	1	9.30	1	5.95	1	5.97	1	6.04	7	6.26
	6 inch	1	6.01	1	9.30					1	6.04	3	7.12
	Maximum		6.01		9.30		5.95		5.97		6.04		6.65

occur during crop seasons, May, June and September being the three heaviest months with between four and five inches, the total for the year averaging 33.57 inches and the average monthly being 2.80 inches.

2. PROBABLE FLOODS AND FREQUENCY.

Let us turn now from the monthly rainfall to the excessive storm periods of one to six days.

Tabulation 1 gives data of storm periods in the same five towns located in the Pecatonica watershed. This shows the number of storms over 2 inches in depth in each town for one, two, three, four, five and six day storm periods and likewise the number of storms over 3 inches and each succeeding inch up to the maximum.

From this chart we derive the following tabulation 2 of maximum rains:

TABULATION 2.

Storm period.	Freeport.	Dodgeville.	Darlington.	Mt. Horeb.	Broadhead.	Average.
1 day	5.91	4.33	3.30	2.80	3.62	3.99
2 days	6.01	7.38	4.30	3.43	5.54	5.33
3 days	6.01	7.71	4.30	4.59	5.54	5.63
4 days	6.01	7.71	4.66	4.61	5.54	5.71
5 days	6.01	9.30	5.95	4.61	5.54	6.28
6 days	6.01	9.30	5.95	5.97	6.04	6.65

Tabulation 1 also shows the depths of excessive rains averaged for the five towns for the different periods and depths.

Summarizing tabulation 1 we see that in Freeport in a period of 10.5 years we had:

2 storms of over 4 inches in 1 day.
3 storms of over 4 inches in 2 days.
4 storms of over 4 inches in 3 days.
6 storms of over 4 inches in 4 days.
6 storms of over 4 inches in 5 days.
7 storms of over 4 inches in 6 days. Maximum 6.01.

In Dodgeville we find in only 2⅔ years:

1 storm of 4 inches in 1 day.
1 storm of 4 inches (7.38) in 2 days.
1 storm of 4 inches (7.71) in 3 days.
2 storms of 4 inches in 4 days.
3 storms of 4 inches in 5 days.
3 storms of 4 inches in 6 days. Maximum 9.30.

In Darlington we find in 10½ years:

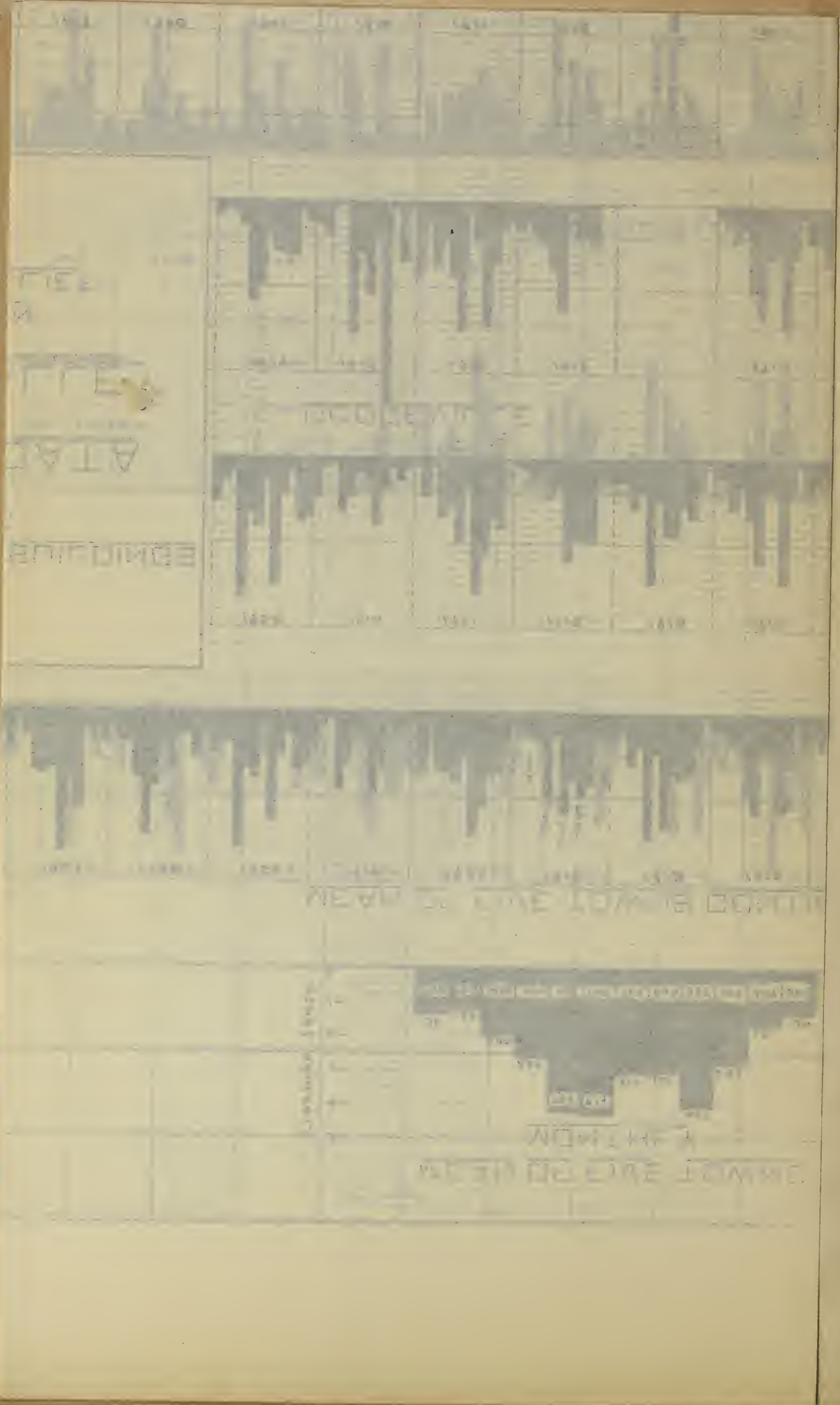
No storm of 4 inches or over in 1 day.
1 storm of 4 inches or over in 2 days.
3 storms of 4 inches or over in 3 days.
4 storms of 4 inches or over in 4 days.
4 storms of 4 inches or over in 5 days.
4 storms of 4 inches or over in 6 days. Maximum 5.95.

In Mt. Horeb in 6½ years we find:

No storms of 4 inches in 1 or 2 days.
2 storms of 4 inches or over in 3 days.
2 storms of 4 inches or over in 4 days.
3 storms of 4 inches or over in 5 days.
5 storms of 4 inches or over in 6 days. Maximum 5.97.

In Brodhead in 10½ years we find:

No storm of 4 inches in 1 day.
1 storm of 4 inches or over in 2 days.
3 storms of 4 inches or over in 3 days.
3 storms of 4 inches or over in 4 days.

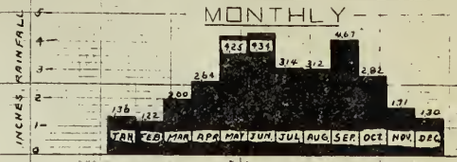


STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF WATERWAYS

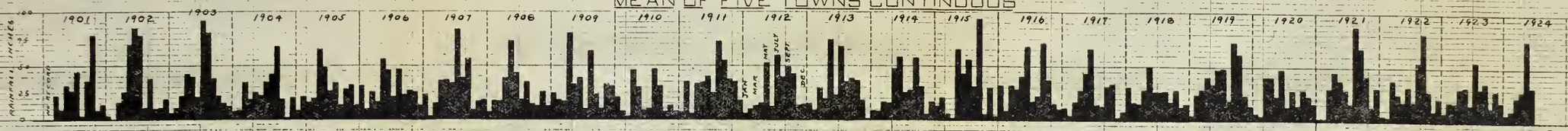
MONTHLY RAINFALL DATA FOR THE PECATONICA RIVER VALLEY

TO ACCOMPANY REPORT ON
PECATONICA RIVER FLOOD RELIEF
1924

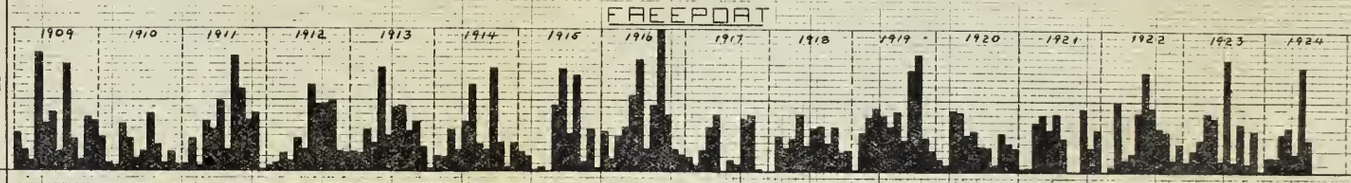
MEAN OF FIVE TOWNS MONTHLY



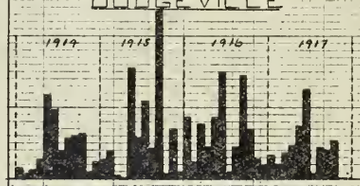
MEAN OF FIVE TOWNS CONTINUOUS



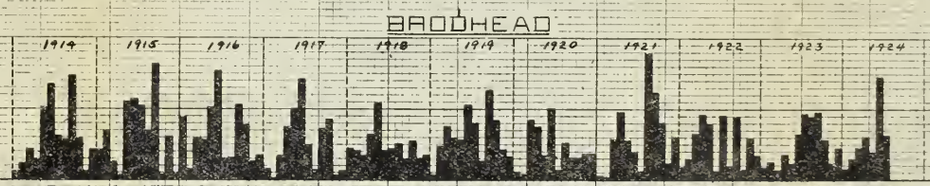
FREEPORT



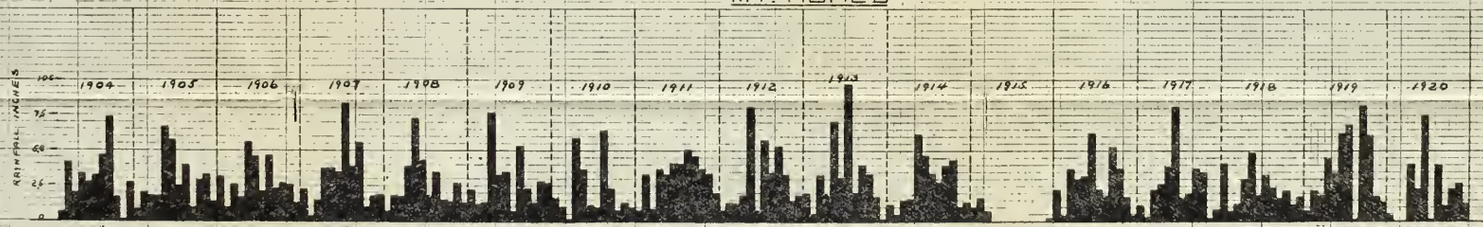
DODGEVILLE



BRODHEAD



MT. HOREB



DARLINGTON

3 storms of 4 inches or over in 5 days.
3 storms of 4 inches or over in 6 days. Maximum 6.04.

The engineers of the Miami Conservancy District in their valuable report on rainfall have made a very extensive study of storms throughout the eastern part of the country and the expected frequency of such storms. From their report we derive the following for the Pecatonica region.

Storms may be normally expected once in 15 years, 25 years, 50 years or 100 years as shown in tabulation 3.

TABULATION 3.

Duration of storm.	1 in 15 yrs. Depth.	1 in 25 yrs. Inches.	1 in 50 yrs. Inches.	1 in 100 yrs. Inches.
1 day	4.0	4.4	5.1	5.4
2 days	4.6	5.2	5.5	6.4
3 days	5.1	5.5	6.0	6.8
4 days	5.4	6.1	6.4	7.0
5 days	5.6	6.2	7.8	7.6
6 days	5.8	6.4	7.0	7.8

It will be noted by referring to the tabulations above that this prediction has been exceeded during the period which observations covered.

3. RUN OFF AND DISCHARGE.

Excessive storms such as shown in the above tables have a great effect in producing a heavy and quick runoff, especially if previous rains have already saturated the ground. Also in case the ground be frozen or covered with snow. The flood of 1916 shows this plainly as the rainfall previous to this high water was not nearly as great as at several other periods, as shown in the rainfall charts above. For example the average monthly rainfall for the month of March, 1916 over the watershed was only 2.85 inches while that of September, 1915 was 9.42 inches; yet the frozen condition of the ground together with the ice and snow conditions made the high water level higher than in the latter month. Thus we see that while the high waters have their origin in the heavy storm periods, the amount of water flowing downstream does not depend on that alone. Run-off of a stream is the amount of water which reaches the stream. It depends on many different things. The slope of the ground, porosity and nature of the soil, evaporation, the amount of timber, cultivated or prairie land, the condition of the ground from previous rainfalls, and many other conditions have their effect on the run off.

In our case in the Pecatonica valley, the runoff comes quickly from the headwaters which are in the hills with sharp slopes. After reaching the Illinois line the land flattens out and the flow becomes slower and in high water times spreads over the banks causing these damaging overflows.

The discharge of a stream is the amount of water passing a given point in a certain time. It is usually designated in cubic feet per second or the number of cubic feet of water passing a certain point in one second. We have no definite figures on the discharge of the Pecatonica River except at one point which is the Hancock Street bridge at Freeport where a U. S. gauge has been established and read daily from October, 1914 to the present time.

Tabulation 4 shows the total number of days in the various months for the ten year period with discharge at various amounts from 500 CFS to the maximum. Also the average number of days for each year of the same discharges.

From this we see that the highest discharges were in January with 1 day exceeding 6,500 CFS, February with 2 days exceeding 14,000, March with 2 days exceeding 15,000 and 1 day of 17,000, and April with 2 days exceeding 12,500 CFS. All of these were probably affected largely by frozen condition of land and river, but such discharges are liable to occur at any time of the year.

PECATONICA RIVER AT FREEPORT.

SUMMARY OF DISCHARGE, OCT. 1, 1914, TO OCT. 1, 1924. TABULATION 4.

Month.	Number of days with discharge in C. F. S. exceeding.																						
	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	6000	6500
October	195	102	52	25	17	13	11	11	10	9	8	5	5	1	1	1							
November	183	104	38	30	10	8	6	5	4	4	3	2	1										
December	147	96	31	9	6	4	3	2															
January	151	86	29	27	16	13	11	10	10	10	10	10	10	10	10	10	10	9	8	6	5	3	1
February	175	121	87	57	52	48	45	42	41	38	37	27	27	25	24	24	19	19	17	16	14	10	6
March	299	240	196	150	127	120	111	100	94	88	79	76	69	60	52	46	38	33	32	26	20	13	9
April	272	189	130	81	54	43	29	23	18	16	14	14	11	10	9	8	8	8	8	7	7	7	6
May	285	155	72	38	20	9	7	3	3	1	1												
June	239	159	78	55	43	32	19	13	12	7	7	5	3	2									
July	199	88	41	22	11	5	4	3	3														
August	155	67	45	34	23	17	16	13	9	8	6	6	5	5	3	3	2						
September	165	105	70	51	38	29	24	22	16	14	13	11	11	10	10	9	9	9	9	6	5	2	
Total for ten years	2,465	1,512	869	579	417	341	286	247	220	195	178	156	142	123	109	101	86	78	74	61	51	35	22
Average	246.5	151.2	86.9	57.9	41.7	34.1	28.6	24.7	22.0	19.5	17.8	15.6	14.2	12.3	10.9	10.1	8.6	7.8	7.4	6.1	5.1	3.5	2.2

10 YEAR AVERAGE OF NUMBER OF DAYS WITH DISCHARGE IN C. F. S. EXCEEDING.

October	19.5	10.2	5.2	2.5	1.7	1.3	1.1	1.1	1.0	0.9	0.8	0.5	0.5	0.1	0.1	0.1							
November	18.3	10.4	3.8	3.0	1.0	0.8	0.6	0.5	0.4	0.4	0.3	0.2	0.1										
December	14.7	9.6	3.1	0.9	0.6	0.4	0.3	0.2															
January	15.1	8.6	2.9	2.7	1.6	1.3	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.6	0.5	0.3	0.1
February	17.5	12.1	8.7	5.7	5.2	4.8	4.5	4.2	4.1	3.8	3.7	2.7	2.7	2.5	2.4	2.4	1.9	1.9	1.7	1.6	1.4	1.0	0.6
March	29.9	24.0	19.6	15.0	12.7	12.0	11.1	10.0	9.4	8.8	7.9	7.6	6.9	6.0	5.2	4.6	3.8	3.3	3.2	2.6	2.0	1.3	0.9
April	27.2	18.9	13.0	8.1	5.4	4.3	2.9	2.3	1.8	1.6	1.4	1.4	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.6
May	28.5	15.5	7.2	3.8	2.0	0.9	0.7	0.3	0.3	0.1	0.1												
June	23.9	15.9	7.8	5.5	4.3	3.2	1.9	1.3	1.2	0.7	0.7	0.5	0.3	0.2									
July	19.9	8.8	4.1	2.2	1.1	0.5	0.4	0.3	0.3														
August	15.5	6.7	4.5	3.4	2.3	1.7	1.6	1.3	0.9	0.8	0.6	0.6	0.5	0.5	0.3	0.3	0.2						
September	16.5	10.5	7.0	5.1	3.8	2.9	2.4	2.2	1.6	1.4	1.3	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.6	0.5	0.2	
Total	246.5	151.2	86.9	57.9	41.7	34.1	28.6	24.7	22.0	19.5	17.8	15.6	14.2	12.3	10.9	10.1	8.6	7.8	7.4	6.1	5.1	3.5	2.2

PECATONICA RIVER AT FREEPORT.

SUMMARY OF DISCHARGE, OCT. 1, 1914, TO OCT. 1, 1924. TABULATION 4.

Month.	Number of days with discharge in C. F. S. exceeding.																					
	7000	7500	8000	8500	9000	9500	10000	10500	11000	11500	12000	12500	13000	13500	14000	14500	15000	15500	16000	16500	17000	17500
October																						
November																						
December																						
January																						
February	6	6	6	4	3	3	2	2	2	2	2	2	2	2	2							
March	9	7	6	6	4	4	4	4	4	2	2	2	2	2	2	2	2	1	1	1	1	
April	6	6	4	3	3	3	3	3	2	2	2	2										
May																						
June																						
July																						
August																						
September																						
Total for ten years	21	19	16	13	10	10	9	9	8	6	6	6	4	4	4	2	2	1	1	1	1	
Average	2.1	1.9	1.6	1.3	1.0	1.0	0.9	0.9	0.8	0.6	0.6	0.6	0.4	0.4	0.4	0.2	0.2	0.1	0.1	0.1	0.1	

10 YEAR AVERAGE OF NUMBER OF DAYS WITH DISCHARGE IN C. S. F. EXCEEDING.

October																						
November																						
December																						
January																						
February	0.6	0.6	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2							
March	0.9	0.7	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	
April	0.6	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2										
May																						
June																						
July																						
August																						
September																						
Total	2.1	1.9	1.6	1.3	1.0	1.0	0.9	0.9	0.8	0.6	0.6	0.6	0.4	0.4	0.4	0.2	0.2	0.1	0.1	0.1	0.1	

THE FREEPORT PROBLEM—4.

a. *Present Situation.*

Freeport, a town of about 20,000 population, is located on both sides of the Pecatonica. On the south side of the river is located most of the business section, on ground high enough to avoid overflow. North of the river is located a very large part of the manufacturing district of the town. Unfortunately nearly all of this part of the town is below the high water line and much of it is below the floods which come periodically, sometimes as often as once a year. Streets are flooded, manufacturing establishments are necessarily closed and the financial loss, due to wages lost, shops closed and transportation interrupted amounts to a high figure. In 1916 the loss was estimated at $100,000 or more. See photographs numbered 1 to 4. Plate 2 is a map of East Freeport, showing the river and the projects as studied herein.

b. *Condition of the River.*

The Pecatonica River is a very tortuous stream and just above Freeport has several large loops and bends, shown on the plate 2 herewith. On these bends the banks are low and they are overtopped in every flood. The soil and sub-soil are a loamy clay, subject to wash and disintegration in the face of a strong current. The width of the river in Freeport is from 110 feet to possibly 160 feet, the average being about 140 feet. Located nearly in the center of the town is Goddard's dam, owned and operated by the Freeport Railway and Light Company, and producing power for traction and lighting purposes. The length of this dam is 119 feet and at medium low water stage it has a head of about 4 feet. In the extreme low water and again at high water periods, the dam produces no available power, and to offset such periods, the Company has an efficient steam auxiliary plant. At various points along the river, sewers enter which dump the sewage of Freeport entirely untreated into the stream. This has caused a foul slimy deposit on the bed of the stream and during the hot low water months of the summer and fall, the floating pollution may be traced both by sight and smell for several miles below town. In many places, encroachments have been made by the manufacturing plants located along the river, which have narrowed the channel considerably. See photographs 5 and 6.

c. *Railroads and Bridges.*

Three railroads and one electric railway enter Freeport, all of which are vitally concerned in the present condition and its improvement. The Illinois Central main line from Chicago to Omaha enters from the east and parallels the river on its right or south banks. It has no bridges in the city but maintains division headquarters and is cramped for space along the river. Its tracks, however, are above high water. The Chicago and Northwestern Railway enters from the east and parallels the left bank of the river, partly below high water line. It crosses the river on a two span plate girder bridge located in a very bad bend of the river. This bridge and its center pier form a serious obstruction to the flow of the stream. This railroad joins with the Illinois Central Railroad on the south bank and uses the same station near Stephenson Street. The Chicago, Milwaukee and St. Paul Railroad comes in from the northeast, maintains a station on the north side and crosses the river on a three span truss bridge, also at a bad angle. This road also maintains a transfer bridge connecting with the Illinois Central Railroad and Chicago and Northwestern Railway. This is a two span bridge located below the Goddard dam. The tracks of the Chicago, Milwaukee and St. Paul Railroad, traversing the manufacturing district of East Freeport, are periodically flooded and put out of commission.

The Rockford and Interurban Electric Railway enters the town from the east parallel to the Chicago and Northwestern Railway and, using streets for trackage, crosses the river on the Stephenson Street highway bridge, a concrete structure of three spans.


CENTER LINE OF PROJECT
CENTER LINE OF PROJECT

State of Illinois
Department of Public Works and Buildings
Division of Waterways

MAP SHOWING
PROPOSED CHANGE IN PECATONICA RIVER
AT
EAST FREEPORT, ILLINOIS
TO ACCOMPANY REPORT ON PECATONICA FLOOD PROTECTION

By W. G. Potter
Drainage Engineer

SCALE

1924

Besides these bridge we have two highway bridges crossing the river, one at Hancock Street and one at VanBuren Street. Practically all of these bridges have either been condemned or have nearly outlived their usefulness and will soon have to be replaced. Along the south bank of the river below Stephenson Street a concrete retaining wall has been built above flood height and beyond this wall in both directions the railroad tracks are also above flood height, but the lack of space between the river and the manufacturing plants and other city developments, prevents the track and station changes which should otherwise come to the city.

d. *Proposed Change in River.*

Three different solutions have been studied for the problem of flood relief, but before taking these up, the plan for widening and using the river in its present location will be considered.

In the first place, in this as well as in the other projects it is considered for the best interest of the town to condemn Goddard's dam. The power is available only for a portion of the time, and by changing the course of the river, the dam would be abolished anyway. Therefore in considering the river in its present location, it is also abolished. The heaviest flood on record at Freeport had a discharge of about 17,000 CFS. A flood of 25 per cent greater discharge may reasonably be expected often enough to be within the limit of economical consideration. To carry 21,000 CFS through its present windings and rough banks would necessitate a channel of 220 feet base with slopes of 2 horizontal to 1 vertical, a depth of 15 feet and with a fall of 2 feet per mile. Leaving the dam out of consideration, this fall can be obtained. However a channel of this base and depth means a width of 280 feet at the top against a present average width of about 140 feet. This would double the present width and still leave considerable of the bank line below high water level and would thus necessitate a levee or wall in such place. The additional width would in many places be hard to obtain except at a very high price. Also all bridges would have to be rebuilt much longer than at present. A channel 250 feet wide with vertical retaining walls on each side and a depth of water of 15 feet would also suffice, but this would entail the heavy cost of retaining walls as well as right of way and new bridges. Because of these conditions this project is not further considered.

All three of the projects considered below consist of new channels leaving the river above town, going through the practically level ground near the eastern limits of town and joining the river below town near the outlet of the little creek which meanders through Taylor Park and then southeast to the river. All three projects are the same from Station 0, the outlet up through the park and across the Chicago, Milwaukee and St. Paul Railway and Henderson Avenue. West of there the projects diverge as shown on the map of the Freeport region.

PROJECT A.

The capacity accepted for study and report was to carry a 21,000 CFS discharge without overflowing the natural banks. This is done with room to spare except in the waste land from Taylor Park to the river. This is low ground subject to overflow several times a year by any very moderate high water. The cross-section assumed is for a 200 foot base with slopes 2 horizontal to 1 vertical. The grade allowed is .04 feet per 100, or 2.112 feet per mile. Station 0 is at the down stream end of the proposed channel. The alignment is straight from Station 0 to Station 35 plus 48 where a 3° curve to left carries the channel to Station 50 plus 67. From this point the channel runs straight and intersects the river at about Station 99. Single track bridges would be required at the Chicago and Northwestern Railroad crossing and at the R. & I. Electric Railway; a double track bridge would be required for the Chicago, Milwaukee and St. Paul Railroad and highway bridges at Taylor Avenue, Henderson Avenue, and at the Cedarville Road.

A right of way 500 feet in width would be required. Below Taylor Park the line follows a small branch as above described, subject to numerous

No. 5. Down stream from R. R. Transfer Bridge in Freeport, showing encroachment on flood area.

No. 6. Up stream from Transfer Bridge in Freeport, showing encroachment on flood area.

overflows and of no great value. It will be necessary to take the north end of Taylor Park but I am told there is no objection to that as the main part of the park would not be affected.

Between Taylor Park and Henderson Avenue the land is tillable but subject to overflow and too flat to drain well at present. It was largely under water at the time of our survey due not to the river but to insufficient drainage. West of Henderson Avenue the land is good and all either in cultivation or in pasturage. It is however, well under the flood height of 1916. The main objection to this route are first, that its upper end is at a point below the bends in the river which cause the most trouble in overflows. The banks of the river above this are mostly low and the river itself bends back to the south and causes overflows at and around the city water works and its wells. Second, this route necessitates the condemnation of land at the upper end now occupied by buildings and houses, and the cost would be consequently greater per acre. The length of Project A is 9,900 feet or 1.87 miles. The cost of this route is estimated as follows:

Excavation, 1,429,000 cu. yds. at 20c	$285,800.00
Right of Way	23,700.00
Purchase of buildings	10,000.00
Bridges, 2 single track R. R.	55,000.00
1 double track R. R.	86,000.00
3 highway bridges	60,000.00
Purchase of Goddard's dam rights	15,000.00
Miscellaneous damages	10,000.00
	$545,500.00
Overhead charges 10 per cent	54,550.00
	$600,050.00
Contingencies 10 per cent	60,005.00
Total estimate	$660,055.00

PROJECT B.

Project B is the same as Project A up to Station 74 plus 75. Here it branches off with a 2° 15′ curve to right which ends at Station 90 plus 70. From here the course is straight till it strikes the river at Station 122. From this point it follows the bend in the river about 650 feet and then by an additional channel 550 feet long again strikes the river at the bend above the rendering works. This route while longer than Project A, will eliminate the three bad bends in the river above town and remove all possible chance of pollution to the city water supply. The bad features are that it goes through some of the best farming land and that it either requires an additional highway bridge over the road leading north from the Cedarville Road, or else requires that that road be closed. The length of this project is 13,400 feet or 2.54 miles.

The estimate of cost for Project B is as follows:

Excavation 1,808,000 cu. yds. at 20c	$361,600.00
Right of Way	32,200.00
Purchase of buildings	5,000.00
Bridges, 2 single track R. R.	55,000.00
1 double track R. R.	86,000.00
4 highway bridges	80,000.00
Purchase of Goddard's dam rights	15,000.00
Miscellaneous damages	10,000.00
	$644,800.00
Overhead charges 10 per cent	64,480.00
	$709,280.00
Contingencies 10 per cent	70,928.00
Total estimate	$780,208.00

PRFJECT C.

This project also has the same route as Project A from the lower end almost to the Cedarville road. Here it diverges and turns to the right on a 3 degree curve. It crosses Cedarville road and runs through a slough west of that point and then straight to a point near the second bend in the river. Here it curves and follows the course of the river till it joins the course of Project B from the second bend of the river to the upper end on the third bend. This route is slightly longer than that of Project B but on the other hand it passes through poorer land and also avoids the extra bridge called for on Project B. The total length by this route is 13,850 feet, or 2.62 miles.

The estimate of cost is as follows:

Excavation 1,190,700 cu. yds. at 20c.....	$358,140.00
Right of Way.....	22,300.00
Bridges, 2 single track R. R.....	55,000.00
1 double track R. R.....	86,000.00
3 highway bridges.....	60,000.00
Purchase of buildings.....	5,000.00
Purchase of Goddard's dam rights.....	15,000.00
Miscellaneous damages, grading of roads, etc...	10,000.00
	$611,440.00
Overhead charges 10 per cent.....	61,144.00
	$672,584.00
Contingencies 10 per cent.....	67,258 00
Total estimate	$739,842.00

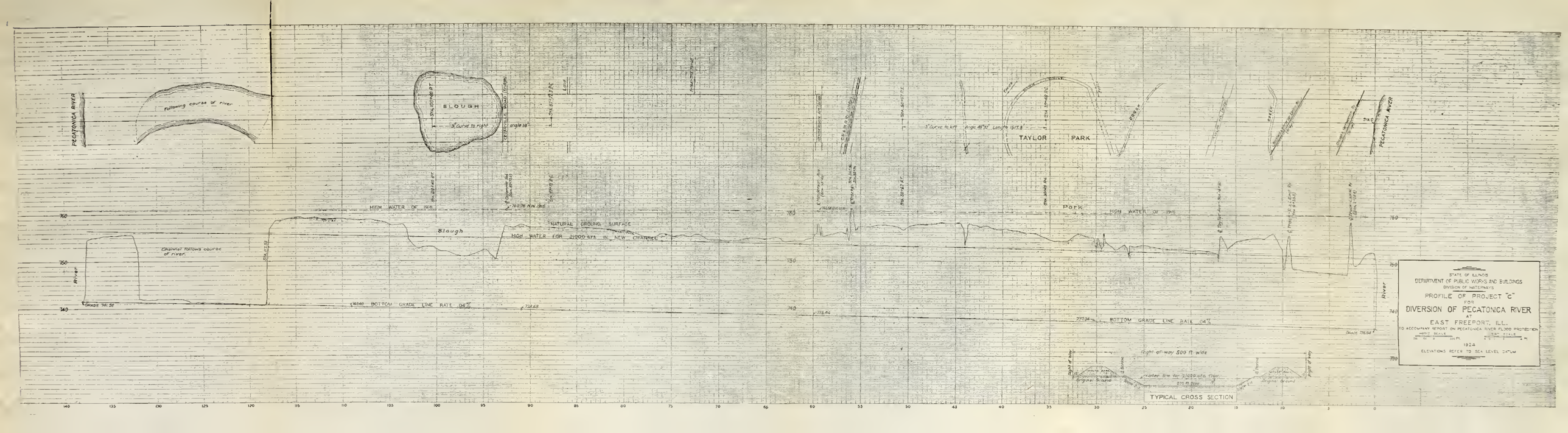
Comparing these three projects we find that Project A is shortest and cheapest in first cost but its point of leaving the river is nearest the city and because of the loops of the river above this point, it would not stop the overflows reaching the water works and that region. Neither would it stop high water from overflowing the banks and the region north of the proposed channel.

Project B is not subject to the above objections of Project A. It also does not confiscate so much of built up property or such valuable buildings. On the other hand it passes through more valuable farm land and also requires an additional highway bridge or else the closing of that county road.

Project C lies between A and B and traverses considerable slough land and poor farming land in place of the good land of B. It does not require either the additional bridge or the closing of the county road which B requires. It is slightly longer than B and much longer than A but its upper end is the same as B and means that no damage or overflow could reach the waterworks, nor could it reach the valley north of the channel. For these reasons it is the opinion of the writer that Project C is the logical location for the diversion and is most feasible. Its increase in cost over Project A is more than counter-balanced by the increased amount and value of the land saved from overflow.

All three projects are shown on the map of the Freeport region, Plate 2 and the profile of Route C is also shown on Plate 3.

In case of the river being diverted to either of these routes, the protection from floods is not the only advantage which would be obtained. The vacant strip, now the river bed, would become very valuable, and would return taxes to the city and county.. Factories abutting on either side would have room to develop their industries and the railroads would have sorely needed room for tracks, yard facilities and new station. The city also would be able to solve at a low cost the sewerage problem now staring it in the face. Without question the State will in the next few years require Freeport to treat its sewage. At present the sewage is emptied raw into the river at numerous points, with the resulting slime and odor in the stream, injurious to health of the town.


PECATONICA RIVER
Following course of river
SLOUGH
S. Curve to right angle 38°
CENTERVILLE ROAD (TODAY)
S. Curve to left Angle 48°30' Length 1317.8
TAYLOR PARK
HIGH WATER OF 1916
NATURAL GROUND SURFACE
HIGH WATER FOR 21000 cfs IN NEW CHANNEL
Channel follows course of river
Slough
Park
River
Grade 741.36
BOTTOM GRADE LINE RATE 04%
Grade 716.84
Right of way 500 ft wide
Original Ground
Water line for 21000 cfs flow
200 ft Base
TYPICAL CROSS SECTION
STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF WATERWAYS
PROFILE OF PROJECT "C"
FOR
DIVERSION OF PECATONICA RIVER
AT
EAST FREEPORT, ILL.
TO ACCOMPANY REPORT ON PECATONICA RIVER FLOOD PROTECTION
HOR. SCALE 1in. = 200 Ft.
VER. SCALE 1in. = 10 Ft.
1924
ELEVATIONS REFER TO SEA LEVEL DATUM

With the river in its present location, an intercepting sewer would have to be laid on each side of the river through almost unobtainable property at an extremely high cost, to a treatment plant below town. With the river diverted, one intercepting sewer could be laid on the bottom of the present stream, connecting with the sewers on each side at a comparatively very low cost. There will be a very large amount of excavated material along the new channel which could be transported at a low cost to fill up the old bed after laying the sewer.

Thus, instead of the town being divided by the river, instead of having a foul noxious stream taking up a large area almost through its center, Freeport would have a clean stream on its outskirts; it would be free from fear of floods; it would have additional taxable area utilized for the good of the town; it could, if required, have a separation of street and railroad grades and it would have its health improved by the removal of raw sewage from the river.

5. THE RIVER BELOW FREEPORT.

a. *Present Condition.*

In taking up the improvement of the river below Freeport the main question is the amount of work that can be done inside the economical limit of expense. There are probably in the neighborhood of forty thousand acres of land now subject to overflow. The expense of making the channel would probably have to be borne by the owners of this land. Therefore the money that can be reasonably obtained from this land would govern the number and size of the cut-offs made. For that reason the cut-offs are all given below with their length, cost and the length of old channel eliminated by each. If enough money can be raised, the channel could be shortened still further. On the other hand the cost could be lessened by leaving out some except that each cut-off omitted would flatten the slope according to the length of channel not eliminated by those cut-offs.

The total length of the present channel from the lower end of the proposed Freeport diversion is about 62 miles. With the cut-offs surveyed and given herein that length is reduced to 38¼ miles. The present channel is tortuous in the extreme, sharp bends forming loops and ox-bows in many places. The banks are all of earth and cutting and erosion of these banks is very common at many of the bends during each high water period. The banks are generally low and often covered with small brush or timber. Few stretches in the channel are free from stumps or trees which have fallen in the river, and in many places the floating debris has collected to form virtual dams. Due to these obstructions and the many swamps and sloughs in the valley, the channel often changes and cuts through in new places. Two of these natural cut-offs were found on the survey of recent development or formation where the current is now cutting its way through.

Theoretically the logical method of improving the stream would be to, as near as possible, run it straight through. This would be entirely impracticable however because of the cost, and many of the flatter curves and bends were left in the proposed channel, and only those considered which would eliminate about three times as much old channel as the length of the cut-off would be. The channel will in places still meander from one side of the flooded area to the other side occasionally.

b. *Dams.*

There are two dams in the river below Freeport. Brown's Mill dam is located a few miles below Freeport. This dam develops a head of about 4 feet at medium low water stage and is used for power by the Pecatonica River Power Company. The effect of this dam during high water is negligible as at such times the water passes over the dam without even a ripple to show its location. For this reason it is contemplated to leave the dam in place and assume a grade line for slope of the river regardless of it.

No. 7. Unused dam at Pecatonica Village, fairly low water.

No. 8. Unused dam at Pecatonica village, abandoned mill foundation at left.

There is another dam located at Pecatonica however which has outlived its usefulness. Formerly a mill stood here and was operated by power from the dam, but the mill has been razed and the dam is now not used for any purpose. Its effect in its present condition is only to raise the water table of the river and low lands above the dam, and thus deprive the owners of the use of part of their land. Because this dam has thus no useful purpose. it is contemplated in this report to remove it as an obstruction to the ordinary stage flow. See photographs 7 and 8.

c. *Bridges.*

There are several bridges over the river below Freeport.

The Chicago and Northwestern Railway Company has a two-span bridge just above Ridott and the R. & I. Electric has a one-span bridge with long trestle approach adjoining the Chicago and Northwestern Railway bridge, both of which would probably be all right without change. At a point a mile north of Ridott on a loop of the river which it is proposed to eliminate, is located a highway bridge which would soon have to be replaced at all events. A new highway bridge is proposed over the new channel in place of this.

The next bridge down stream is the Farwell highway bridge located about midway between Ridott and Pecatonica. The channel here is unchanged in position but an additional approach span may be necessary as the length of this bridge is only 151.5 feet. See photograph 10.

The next is a concrete highway bridge of 4 spans located at Pecatonica. The channel here is unchanged in position and the bridge is considered all right. See photograph 9.

About half way between Pecatonica and Harrison is located the Trask bridge. This is an ancient highway bridge already condemned and marked "You cross here at your own risk." The channel is unchanged here but a new and longer bridge should replace the structure. Because of its being already condemned, it is however not included in the estimate of cost herewith.

The next and last bridge is a highway bridge located at Harrison and no change is contemplated in it.

d. *Proposed Cut-offs and Changes.*

Before taking up the cut-offs in detail the general resulting changes in grade and high water elevation will be discussed. Starting at mile 0, at the point where the Freeport diversion channel enters the river, a grade is established of 1.017 foot per mile extending to the lower end of cut-off R at mile 25.75. This disregards the dam at Brown's Mill and the one at Pecatonica. From mile 25.75 to the mouth of the Pecatonica at mile 38.25 the slope of the valley is very small and the gradient is correspondingly flat being only 0.3 foot per mile. Computations on the cross-section required for the flow are made on the assumption of 21,000 CFS at mile 0 which is twenty-five per cent larger than any flood on record. Kutter's formula is used, with the coefficient for roughness of .025 and the grade or slope being 1.017. This shows that with a 200 foot base the water line at 21,000 CFS flow will be 18 feet above the bottom grade. This will overtop the banks in some places but the flooded area would be comparatively small. To avoid any flooding would necessitate a channel about 50 feet wider than here given for its entire length which would mean an increased cost of about 25 per cent and make the project prohibitive.

The 200 foot base is used to the lower end of cut-off F in which the Little Pecatonica River outlets. From this point to mile 25.75 a base of 225 feet is used. At this point the grade changes to 0.3 foot per mile and the channel is again widened to 250 feet. At the junction with the Sugar River, the stream is again widened to a base of 300 feet and thus maintained to the outlet into Rock River. For several miles above the mouth, the flood water from the Rock River will overflow the low grounds regardless of the Pecatonica and little can be done there except to clean out the stream and assist the water to get away as fast as possible.

The cut-offs as proposed will now be taken up serially and briefly described. Their location will be seen by referring to plates 4 to 7 which

No. 9. Pecatonica Highway Bridge in high water of 1922.

No. 10. Farwell Bridge.

STATE OF ILLINOIS

DEPARTMENT OF PUBLIC WORKS AND BUILDINGS

DIVISION OF WATERWAYS

SECTION I OF MAP OF PECATONICA RIVER VALLEY BELOW FREEPORT, TRACED FROM ILL. GEOL. SURVEY MAP, SHOWING PROPOSED CHANNEL CHANGES AND DECREASED MILEAGE OF RIVER.

To accompany report on Flood Protection of Pecatonica River

SCALE OF FEET

2000 1000 0 2000 4000 6000

1924

(21) INDICATES PRESENT MILEAGE BELOW FREEPORT.

[10] INDICATES PROPOSED MILEAGE BELOW FREEPORT DIVERSION.

consist of reproductions of the maps made by the State geological survey on which the cut-offs are shown by heavy broken lines. The new mileage is also shown thereon from the Freeport division to the mouth. On the profile, Plate 8, is shown the approximate bottom of the river, the grade line for the bottom, the expected new high water line and the present high water line derived from what high water marks were obtainable and reasonably reliable. The probability is that the most economical method of making the cut-offs, because of the great width of channel, would be by hydraulic dredge. In that case it would be an easy matter to run the pipe line to the sloughs which are so numerous along the river and turn the excavated material into them. Thus new and rich tillable land would replace the waste sloughs and at the same time the high spoil banks would be avoided. Where sloughs were not within reach the spoil banks would be much lower and spread out much more because of the water carried with the dirt. Thus these banks would be much easier prepared for cultivation.

CUT-OFF A.

This cut-off is 3,250 feet long and eliminates 16,850 feet (3.19 miles) of old channel. The ground through which this cut-off extends is nearly all good land now in cultivation and the depth of cut in places is considerable. The right-of-way required would be 500 feet in width.

Estimate of Cost:

Right of Way	$ 9,250.00
Excavation, 504,045 cu. yds. at 20c	100,809.00
Total	$110,059.00

Between Cut-offs A and B the course of the river is reversed as shown on the map.

CUT-OFF B.

This is a very long cut-off, 6,035 feet, but it eliminates 19,325 feet or 3.66 miles of old channel. This is also practically all cultivated land or pasture excepting a slough a few hundred feet in length. A right of way of 500 feet is required.

Estimate of Cost:

Right of Way	$ 13,860.00
830,775 cu. yds. at 20c	166,155.00
Total	$180,115.00

CUT-OFF C.

This cut-off is at Ridott and eliminates a long bend in which is located the present Ridott highway bridge. The bridge is in bad condition and would soon have to be replaced in any event. A new bridge at the new location is included in the estimate. The length of this cut-off is 2,620 feet and it eliminates about 13,200 feet of old channel. The ground required is partly slough and partly in cultivation.

Estimate of Cost:

Right of Way	$ 5,250.00
389,500 cu. yds. excavation at 20c	77,900.00
New bridge	15,000.00
Total	$98,150.00

CUT-OFF D.

This is a short cut-off, only 460 feet in length. It however eliminates about 2,960 feet of old channel. The ground is mostly in slough and brush and not cultivated.

Estimate of Cost:

Right of Way	$ 550.00
53,050 cu. yds. of excavation at 20c	10,610.00
Total	$11,160.00

CUT-OFF E.

This is also a short one with length of 950 feet, however it eliminates about 10,030 feet or 1.9 miles of old channel, nearly 11 times its length. It traverses some timber but mostly pasture land.

Estimate of Cost:

Right of Way	$ 1,635.00
164,290 cu. yds. excavation at 20c	32,858.00
Total	$34,493.00

Between cut-offs E and F, Farwell bridge is located. There is a possible cut-off just above this bridge, but as there is quite a large branch entering the river which would necessitate keeping much of the old channel open anyway, the cut-off was not considered advisable.

CUT-OFF F.

This is the longest cut-off proposed. As will be seen on the map, it crosses the Little Pecatonica and also several loops of the main stream and ends in the old channel at the Pecatonica Fair Grounds. The ground is mostly slough and timber with some pasture and cultivation. The length is 7,710 feet and it eliminates about 30,675 feet or 5.81 miles of old channel, full of twists and turns, and excelling in places for logs and debris to choke the channel.

Estimate of Cost:

Right of Way	$ 7,530.00
1,174,845 cu. yds excavation at 20c	234,969.00
Total	$242,499.00

Below this cut-off, because of the additional flow from the Little Pecatonica, it is necessary to widen the channel from 200 to 225 foot base. This will give a capacity of 24,054 C.F.S. at a depth of 18 feet. The width of right-of-way will also have to be increased from 500 to 600 feet at this point. Pecatonica dam lies just below cut-off F and as explained above in this report, it is now serving no useful purpose and its removal is contemplated. About a half-mile below the dam is located the Pecatonica bridge. No change is in view at this point.

CUT-OFF G.

This lies in pasture and slough land. It is 1,550 feet long, eliminating about 3,960 feet of old channel.

Estimate of Cost:

Right of Way	$ 2,140.00
214,020 cu. yds. of excavation at 20c	42,804.00
Total	$44,944.00

CUT-OFF H.

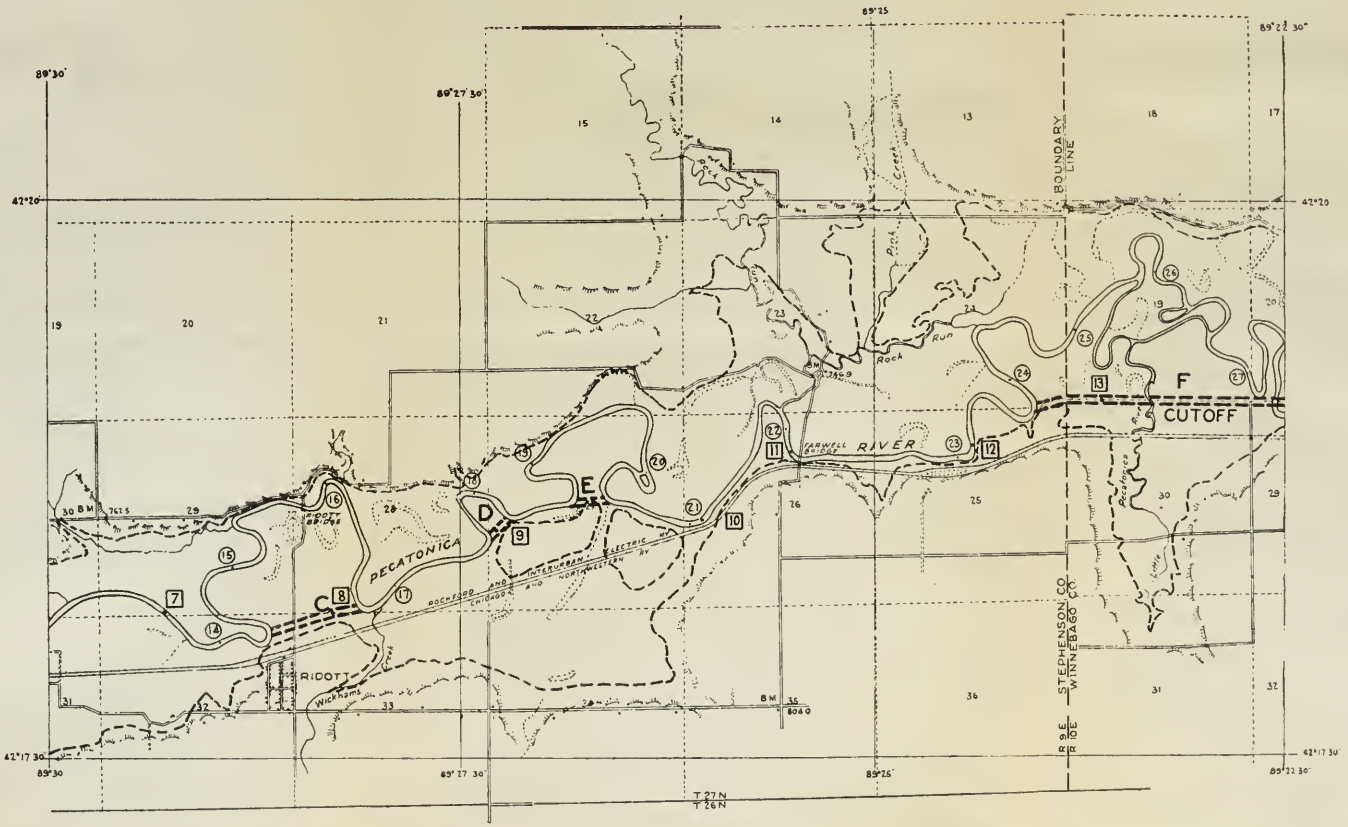
This is a very short one, only 415 feet in length and eliminates about 2,100 feet of old channel. It is already the bed of a natural flood channel, ans is poor land.

Estimate of Cost:

Right of Way	$ 285.00
50,870 cu. yds. of excavation at 20c	10,174.00
Total	$10,459.00

Below cut-off H we found the site for the next cut-off already opened up by the high waters and rapidly widening out by the current causing the banks to cave.

This cut is only about 250 feet long and it eliminates about 3,960 feet of old channel. No estimate is included for this cut-off.



STATE OF ILLINOIS

DEPARTMENT OF PUBLIC WORKS AND BUILDINGS

DIVISION OF WATERWAYS

SECTION 2 OF MAP OF PECATONICA RIVER VALLEY BELOW FREEPORT, TRACED FROM ILL. GEOL. SURVEY MAP, SHOWING PROPOSED CHANNEL CHANGES AND DECREASED MILEAGE OF RIVER.

To accompany report on Flood Protection of Pecatonica River

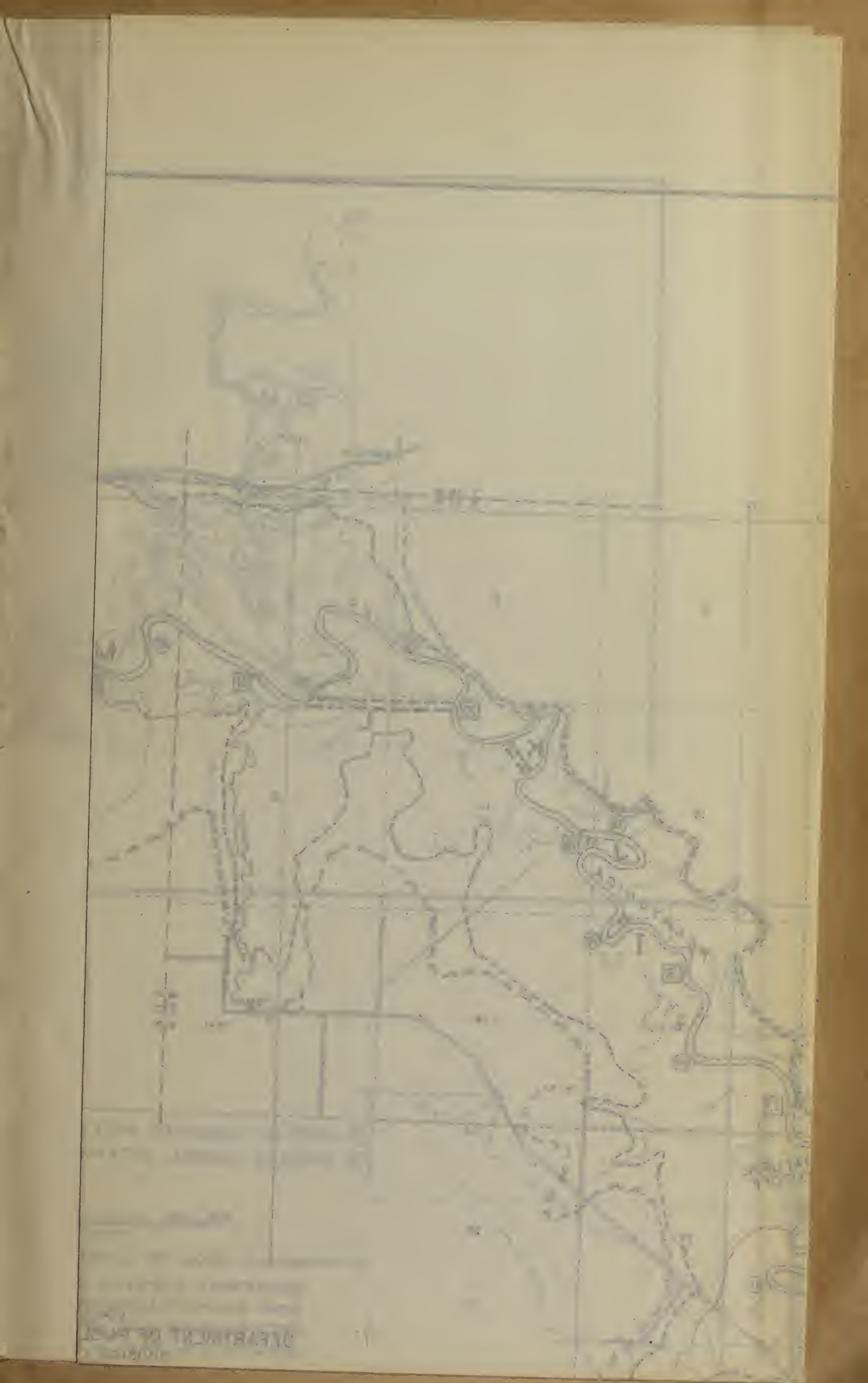
SCALE. OF FEET

2000 1000 0 2000 4000 6000

1924

(21) INDICATES PRESENT MILEAGE BELOW FREEPORT

[10] INDICATES PROPOSED MILEAGE BELOW FREEPORT DIVERSION



STATE OF ILLINOIS

DEPARTMENT OF PUBLIC WORKS AND BUILDINGS

DIVISION OF WATERWAYS

SECTION 3 OF MAP OF PECATONICA RIVER VALLEY BELOW FREEPORT, TRACED FROM ILL. GEOL. SURVEY MAP, SHOWING PROPOSED CHANNEL CHANGES AND DECREASED MILEAGE OF RIVER.

To accompany report on Flood Protection of Pecatonica River

SCALE OF FEET

2000 1000 0 1000 2000 3000

1924

(21) INDICATES PRESENT MILEAGE BELOW FREEPORT

[10] INDICATES PROPOSED MILEAGE BELOW FREEPORT DIVERSION.

CUT-OFF I.

This is only about 250 feet in length, eliminating about 1,600 feet of old channel. It lies in poor ground.

Estimate of Cost:

Right of Way	$ 170.00
35,690 cu. yds. of excavation at 20c	7,138.00
Total	$7,308.00

CUT-OFF J.

This is another cut made by nature in its high water ravages. This has been temporarily partly blocked by rock thrown into the break by the land owner, but the channel is bound to cut its way through in spite of his efforts. Its length is about 330 feet and it eliminates about 2,800 feet of old channel. No estimate is allowed for this cut-off.

CUT-OFF K.

This traverses some heavy timber land and considerable slough land. Its length is 1,315 feet and it eliminates about 3,600 feet of old channel.

Estimate of Cost:

Right of Way	$ 905.00
205,240 cu. yds. of excavation at 20c	41,048 00
Total	$41,953.00

CUT-OFF L.

This is a long cut-off traversing a mixture of pasture, timber, slough and cultivated land. It is largely good cultivatable ground. Its length is 3,860 feet and it eliminates about 8,000 feet of old channel.

Estimate of Cost:

Right of Way	$ 7,980.00
635,575 cu. yds. of excavation at 20c	127,115.00
Total	$135,095.00

This cut-off might be omitted without serious consequences.

CUT-OFF M.

This lies in part pasture and part timber land. Its length is 500 feet and it eliminates about 2,640 feet of old channel.

Estimate of Cost:

Right of Way	$ 1,035.00
76,900 cu. yds. of excavation at 20c	15,380.00
Total	$16,415.00

CUT-OFF N.

This is also partly timber and partly pasture and is mostly good cultivatable land. Its length is 770 feet and it eliminates 2,970 feet of old channel.

Estimate of Cost:

Right of Way	$ 1,590.00
107,530 cu. yds. of excavation at 20c	21,506.00
Total	$23,096.00

CUT-OFF O.

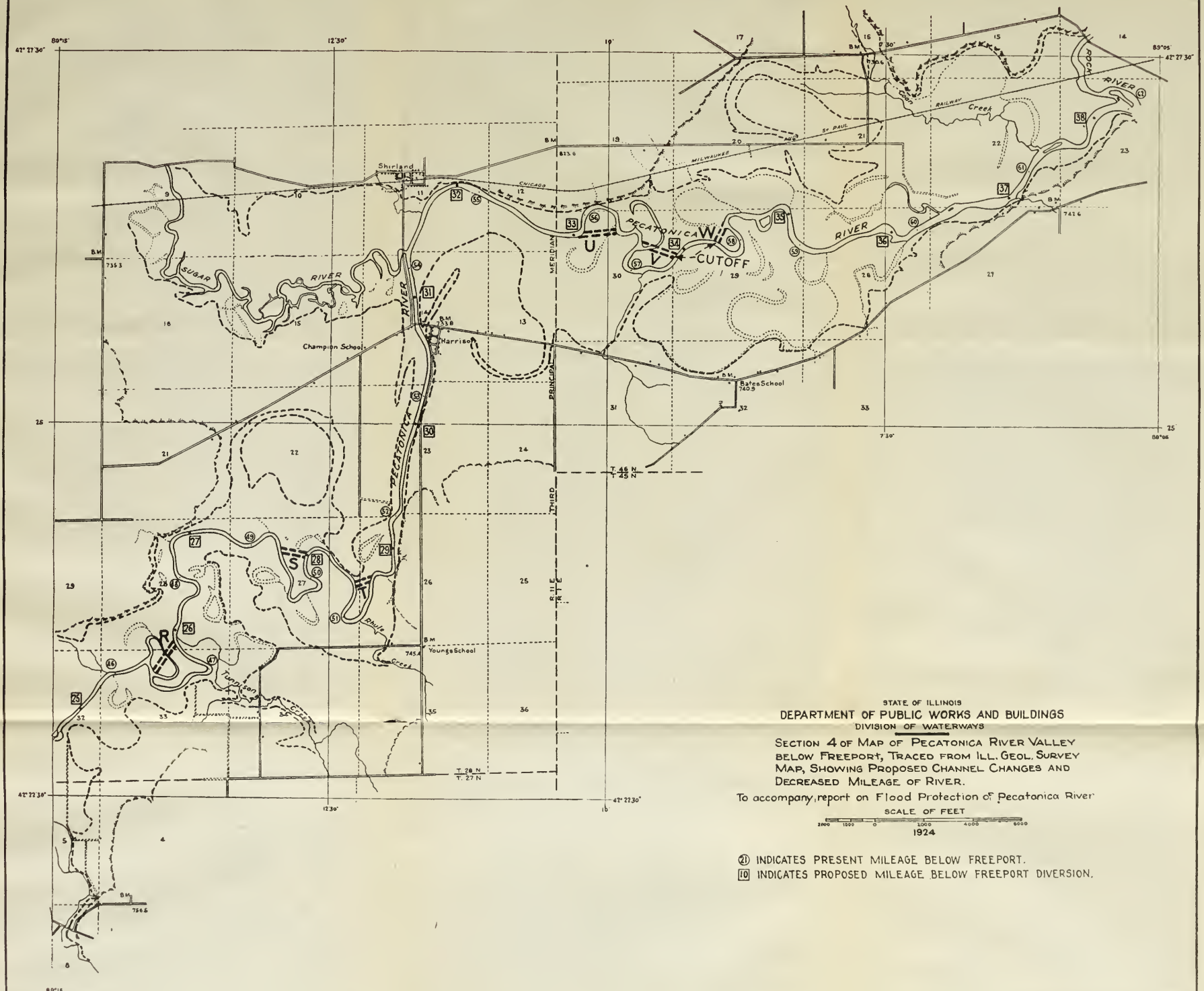
This cut-off lies about one-half mile below Trask Bridge. It goes through a wilderness of brush and timber and is entirely uncultivated. Its length is 456 feet and it eliminates 2,640 feet of old channel.

Estimate of Cost:

Right of Way	$ 315.00
74,330 cu. yds. of excavation at 20c	14,866.00
Total	$15,181.00

No. 11. Collection of drift in Pecatonica River.

No. 12. Pecatonica River at outlet of Sugar River. Bridge over Sugar River shown at left.



STATE OF ILLINOIS

DEPARTMENT OF PUBLIC WORKS AND BUILDINGS

DIVISION OF WATERWAYS

SECTION 4 OF MAP OF PECATONICA RIVER VALLEY BELOW FREEPORT, TRACED FROM ILL. GEOL. SURVEY MAP, SHOWING PROPOSED CHANNEL CHANGES AND DECREASED MILEAGE OF RIVER.

To accompany report on Flood Protection of Pecatonica River

SCALE OF FEET

2000 1000 0 1000 4000 6000

1924

(21) INDICATES PRESENT MILEAGE BELOW FREEPORT.

[10] INDICATES PROPOSED MILEAGE BELOW FREEPORT DIVERSION.

CUT-OFF P.

This is also through timber and brush but much better land than the last one. Its length is 790 feet and it eliminates about 3,960 feet of old channel.

Estimate of Cost:

Right of Way	$ 1,090.00
129,210 cu. yds. excavation at 20c	25,842.00
Total	$26,932.00

CUT-OFF Q.

This is again mostly timber land, badly cut up by washes from different high waters. Its length is 684 feet and it eliminates about 2,640 feet of old channel.

Estimate of Cost:

Right of Way	$ 940.00
106,420 cu. yds. excavation at 20c	21,284.00
Total	$22,224.00

CUT-OFF R.

This is poor waste ground cut up by old channels of the river and covered with brush. Its length is 1,295 feet and it eliminates about 5,440 feet of old channel and some very bad debris-collecting bends and twists. See photograph 11.

Estimate of Cost:

Right of Way	$ 890.00
225,640 cu. yds. of excavation at 20c	45,128.00
Total	$46,018.00

At the lower end of this cut-off, the grade of the river bottom flattens to 0.3 foot per mile and this again necessitates widening the base to accommodate the discharge. The cross-section of the channel here changes to 250 feet base but the right-of-way width is maintained at 600 feet.

CUT-OFF S.

This traverses good ground, much of which is in cultivation. It has a length of 1,100 feet and eliminates about 4,750 feet of old channel.

Estimate of Cost:

Right of Way	$ 2,280.00
188,315 cu. yds. excavation at 20c	37,663.00
Total	$39,943.00

CUT-OFF T.

This has a length of 560 feet and eliminates about 3,650 feet of old channel. It largely traverses waste ground, but also some good cultivatable ground.

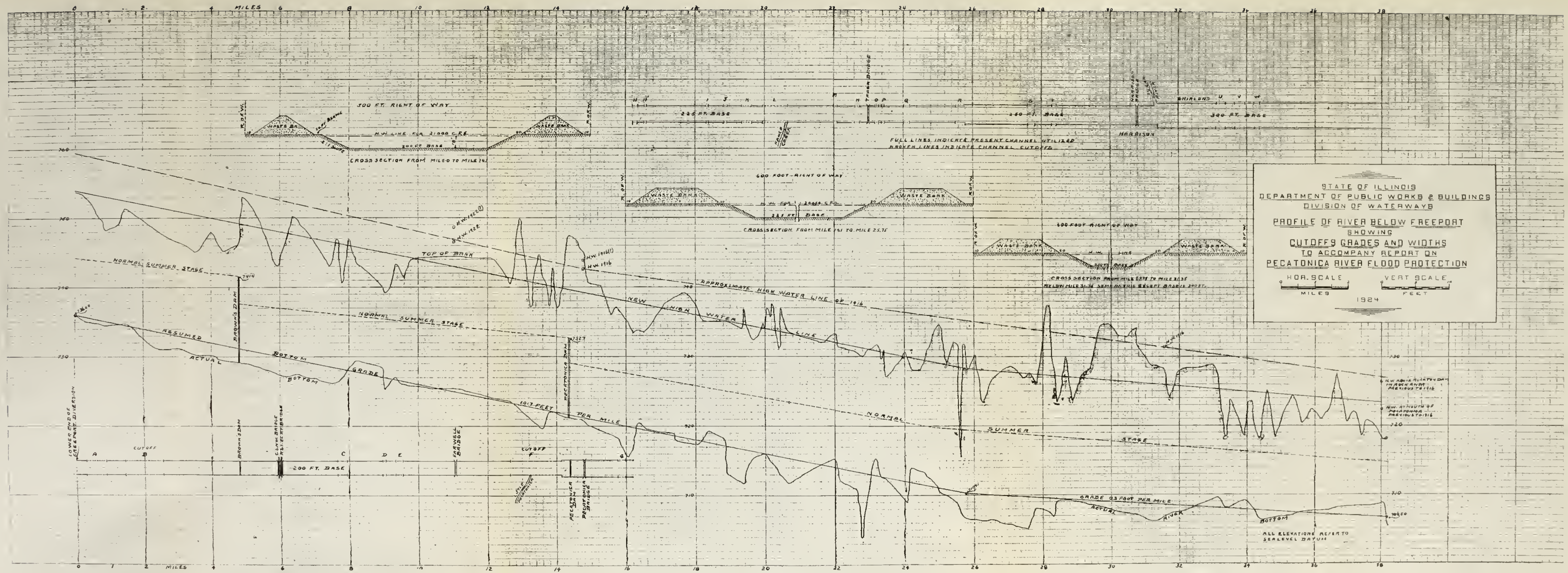
Estimate of Cost:

Right of Way	$ 770.00
88,405 cu. yds. of excavation at 20c	17,681.00
Total	$18,451.00

Between cut-offs T and U lies the mouth of Sugar River which has a heavy high water flow and will necessitate again widening the channel to a 300 foot base. The width of right-of-way is also increased to 650 feet. See photograph 12.

No. 13. Rock River, showing islands. Outlet of Pecatonica River near extreme left.

No. 14. Outlet of Pecatonica River. Rock River in background.


STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS & BUILDINGS
DIVISION OF WATERWAYS
PROFILE OF RIVER BELOW FREEPORT
SHOWING
CUTOFFS GRADES AND WIDTHS
TO ACCOMPANY REPORT ON
PECATONICA RIVER FLOOD PROTECTION
HOR. SCALE
MILES
VERT SCALE
FEET
1924
300 FT. RIGHT OF WAY
CROSS SECTION FROM MILE 0 TO MILE 14.5
600 FOOT RIGHT OF WAY
CROSS SECTION FROM MILE 14.5 TO MILE 25.75
FULL LINES INDICATE PRESENT CHANNEL UTILIZED
BROKEN LINES INDICATE CHANNEL CUTOFFS
NORMAL SUMMER STAGE
APPROXIMATE HIGH WATER LINE OF 1916
NEW HIGH WATER LINE
TOP OF BANK
RESUMED BOTTOM GRADE
ACTUAL BOTTOM
2.17 FEET PER MILE
GRADE 0.3 FOOT PER MILE
ACTUAL RIVER BOTTOM
ALL ELEVATIONS REFER TO SEALEVEL DATUM
200 FT. BASE
MILES

CUT-OFF U.

The length of this cut-off is 1,305 feet and it eliminates about 3,630 feet of old channel. It traverses good tillable land.

Estimate of Cost:

Right of Way	$ 2,925.00
246,060 cu. yds excavation at 20c	49,212.00
Total	$52,137.00

SUMMARY OF DATA ON CUT OFFS BELOW FREEPORT. TABULATION 5.

Cut off.	Length.	Length eliminated.	Right of way estimated cost.	Excavation.		Total estimate.
				cu. yds.	Estimate of cost.	
A	3,250	16,850	$ 9,250	504,045	$100,809	$110,059
B	6,035	19,325	13,860	830,775	166,155	180,015
C	2,620	13,200	5,250	389,500	77,900	83,150
D	460	2,960	550	53,050	10,610	11,160
E	950	10,030	1,635	164,290	32,858	34.493
F	7,710	30,675	7,530	1,174,845	234,969	242,499
G	1,550	3,960	2,140	214,020	42,804	44,944
H	415	2,100	285	50,870	10,174	10,459
H	250	3,960				
I	250	1,600	170	35,690	7,138	7,308
J	330	2,800				
K	1,315	3,600	905	205,240	41,048	41,953
L	3,860	8,000	7,980	635,575	127,115	135,095
M	500	2,640	1,035	76,900	15,380	16,415
N	770	2,970	1,590	107,530	21,506	23,096
O	456	2,640	315	74,330	14,866	15,181
P	790	3,960	1,090	129,210	25,842	26,932
Q	685	2,640	940	106,420	21,284	22,224
R	1,295	5,440	890	225,640	45,128	46,018
S	1,100	4,750	2,280	188,315	37,663	39,943
T	560	3,650	770	88,405	17,681	18,451
U	1,305	3,630	2,925	246,060	49,212	52,137
V	1,602	3,630	2,390	270,790	54,158	56,548
W	505	2,310	1,125	92,730	18,546	19,671
Total	38,563	159,320	$64,905	5,864,230	$1,172,846	$1,237,751

CUT-OFF V.

About half of this consists of a dead branch of the river which will have to be deepened and widened. The balance is very good cultivatable land. The length is 1,602 feet and it eliminates about 3,630 feet of old channel.

Estimate of Cost:

Right of Way	$ 2,390.00
270,790 cu. yds. excavation at 20c	54,158.00
Total	$56,548.00

CUT-OFF W.

This is the last cut-off made on the survey. It traverses good land. Its length is 505 feet and it eliminates about 2,310 feet of old channel.

Estimate of Cost:

Right of Way	$ 1,125.00
92,730 cu. yds. of excavation at 20c	18,546.00
Total	$19,671.00

Below cut-off W the river is reasonably straight to its mouth near Rockton and needs nothing more than cleaning the channel free from logs and debris. In case the work could be carried on a few miles down the Rock River, it would help matters very much to dredge out the bottom of the

Pecatonica near its mouth, but as the Rock River has a rock bottom and is very shallow below the Pecatonica, dredging the latter alone would do no good. See photographs 13 and 14.

To the cost of these cut-offs should be added the cost of cleaning away the logs, debris, etc., on those portions of the river between cut-offs. About thirty-one miles of old channel would still be utilized and the average cost per mile would probably be about $1,000.

Below in Tabulation 5 is given a summary of the foregoing information about the cut-offs.

From Tabulation 5 we find that the total length of cut-offs is 38,563 feet or 7.3 miles. The total length of old channel eliminated by these cut-offs is 157,320 feet or 29.8 miles, over four times the length of the cut-offs. About 480 acres of land are required for right of way at an estimated cost of $64,905.00.

Summarizing Tabulation 5 and adding items of expense not there given we have the following estimate of cost for the work below the Freeport Diversion:

Right of Way	$ 64,905.00
Excavation	1,172,846.00
Bridge on Cut-off C	15,000.00
Removing logs and debris	31,000.00
	$1,283,751.00
Overhead 10 per cent	128,375.00
	$1,412,126.00
Contingencies 5 per cent	70,606.00
Total estimate	$1,482,732.00

Assuming the amount of land in the Pecatonica valley below Freeport which is subject to overflow as 40,000 acres, the cost per acre for the work below Freeport, according to this estimate, would be about $37.00 and including the Freeport diversion, route C, would be about $54.00 per acre.

Serious objection may be raised to the work below Freeport, because of the fact that the cut-offs will divide property so that the part cut-off will not be available for cultivation by the present owner. Therefore he would either be obliged to sell to the adjacent owner or else be badly handicapped in cultivating the land cut-off. Bridges ordinarily would be too far away and his only means of access would be by boat.

In spite of the lowering of the high water line by these cut-offs, some of the low lands will still be subject to occasional overflow. To insure that all of the land would be above all floods would render the cost so high as to be a practical confiscation of the land.